

# **PROJECT MANUAL CONSTRUCTION DOCUMENTS**

## **BRUNSWICK COMMUNITY COLLEGE Alan Holden Public Safety Center**

301 COLLEGE ROAD NORTHEAST

BOLIVIA, NC 28422

STATE CONSTRUCTION OFFICE PROJECT NO: 22-25751-02A

November 4, 2024



SAWYER SHERWOOD & ASSOCIATE, P.C.  
124 MARKET STREET  
WILMINGTON, NC 208401

## ADVERTISEMENT FOR BIDS

Sealed proposals will be received until 3:00 P.M.  
on December 12, 2024, in Building "A" - Boardroom #A-238, for the  
construction of the Brunswick Community College-Alan Holden Public  
Safety Center at which time and place bids will be opened and read.

Complete plans and specifications for this project can be  
obtained from: Sawyer Sherwood & Assoicate, P.C. during normal  
office hours after November 11, 2024.

Plan Deposit \$350.00

The state reserves the unqualified right to reject any and all  
proposals.

Signed: 

The Trustees of Brunswick Community College

Date: NOV 8, 2024

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# NOTICE TO BIDDERS

Sealed proposals will be received by the The Trustees of Brunswick Community College and/or Dr. Gene Smith, President, and/or Mike Ballinger in Bolivia, NC, in the office of Mike Ballinger, Executive Director of Facility Services; Brunswick Community College, 50 College Rd. NE, Bolivia, NC 28422; Bid opening location to held in Building A – Boardroom A-238 up to 3:00 pm on December 12, 2024, and immediately thereafter publicly opened and read for the furnishing of labor, material and equipment entering into the construction of

Brunswick Community College – Alan Holden Public Safety Center  
SCO Project Number 22-25751-02A

The project consists of site work including infilling of aquiculture ponds, new parking lots, stormwater improvements, utility connections, and landscaping. Building construction includes a new building of roughly 28,278 sf. The new building includes a structural steel frame, brick veneer and metal siding, single ply membrane roofing, aluminum storefront, interior gypsum walls, plumbing, mechanical, and electrical systems.

Bids will be received for Contract type – single prime. All proposals shall be lump sum.

## Pre-Bid Meeting

An open pre-bid meeting will be held for all interested bidders on November 19, 2024, at 3:00 P.M. in Building A, 50 College Rd. NE, Bolivia, NC 28422. The meeting will address project specific questions, issues, bidding procedures and bid forms. The site will be made available this day for all contractors and sub-contractors.

*The meeting is also to identify preferred brand alternates and their performance standards that the owner will consider for approval on this project.*

*In accordance with GS133-3 and SCO procedures the following preferred brand items are being considered as Alternates by the owner for this project:*

*A. Corbin Russwin B. Norton C. Dorma D. DDC by Hoffman Building Technologies*

*Justification of any approvals will be made available to the public in writing no later than seven (7) days prior to bid date.*

Complete plans, specifications and contract documents will be open for inspection in the offices of Mike Ballinger and Sawyer Sherwood & Associate, P.C. and online at the Associated General Contractors, Carolinas Branch ([www.constructconnect.com](http://www.constructconnect.com)), in the local North Carolina offices of Dodge Data and Analytics/Dodge Construction Network ([www.construction.com/solutions/dodge-construction-central/](http://www.construction.com/solutions/dodge-construction-central/)), Construction Market Data (CMD) ([pspproileads@cmdgroup.com](mailto:pspproileads@cmdgroup.com), 800-424-3996), in Duncan-Parnell's planroom ([www.duncan-pannell.com/planrooms](http://www.duncan-pannell.com/planrooms), 910-341-3005), East Coast Digital Plan Room ([www.speedyblue.com/East-Coast-Digital-Planroom-c39065011](http://www.speedyblue.com/East-Coast-Digital-Planroom-c39065011), 252-758-1616).

or may be obtained by those qualified as prime bidders, upon deposit of Three Hundred Fifty dollars (\$350.00) in cash or certified check. The full plan deposit will be returned to those bidders provided all documents are returned in good, usable condition within ten (10) days after the bid date.

**NOTE:** The bidder shall include with the bid proposal the form *Identification of Minority Business Participation* identifying the minority business participation it will use on the project and shall include either *Affidavit A* or *Affidavit B* as applicable. Forms and instructions are included within the Proposal Form in the bid documents. Failure to complete these forms is grounds for rejection of the bid. (GS143-128.2c Effective 1/1/2002.)

All contractors are hereby notified that they must have proper license as required under the state laws governing their respective trades.

General contractors are notified that Chapter 87, Article 1, General Statutes of North Carolina, will be observed in receiving and awarding general contracts. General contractors submitting bids on this project must have license classification for Building Contractor.

*(set forth the license classification required by the NC General Contractors Licensing Board under [G.S. 87-1](#)*

NOTE--SINGLE PRIME CONTRACTS: Under GS 87-1, a contractor that superintends or manages construction of any building, highway, public utility, grading, structure or improvement shall be deemed a "general contractor" and shall be so licensed. Therefore a single prime project that involves other trades will require the single prime contractor to hold a proper General Contractors license. **EXCEPT:** On public buildings being bid single prime, where the total value of the general construction does not exceed 25% of the total construction value, contractors under GS87- Arts 2 and 4 (Plumbing, Mechanical & Electrical) may bid and contract directly with the Owner as the SINGLE PRIME CONTRACTOR and may subcontract to other properly licensed trades. [GS87-1.1- Rules .0210](#)

Each proposal shall be accompanied by a cash deposit or a certified check drawn on some bank or trust company, insured by the Federal Deposit Insurance Corporation, of an amount equal to not less than five percent (5%) of the proposal, or in lieu thereof a bidder may offer a bid bond of five percent (5%) of the bid executed by a surety company licensed under the laws of North Carolina to execute the contract in accordance with the bid bond. Said deposit shall be retained by the owner as liquidated damages in event of failure of the successful bidder to execute the contract within ten days after the award or to give satisfactory surety as required by law.

A performance bond and a payment bond will be required for one hundred percent (100%) of the contract price.

Payment will be made based on ninety-five percent (95%) of monthly estimates and final payment made upon completion and acceptance of work.

No bid may be withdrawn after the scheduled closing time for the receipt of bids for a period of 30 days.

The owner reserves the right to reject any or all bids and to waive informalities.

Designer:

Douglas K. Sherwood, AIA

Sawyer Sherwood & Associate, P.C.

124 Market Street, Wilmington, NC 28401

910-762-0892

Owner:

Alan Holden, BCC Board Chair

The Trustees of Brunswick Community College

50 College Road, Bolivia, NC 28422

910-755-7300

Preferred hardware:

Alternate No. G-1 - Preferred Hardware:

1. Base Bid Item: Any manufacturer listed in Specifications 08 7100.

2. Alternate Item: Cobin Russwin (locksets), Norton (closeers), Dorma (locks).

The meeting to discuss the preferred hardware shall take place during the Pre-Bid Meeting.



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**INSTRUCTIONS TO BIDDERS  
AND  
GENERAL CONDITIONS OF THE CONTRACT**

**STANDARD FORM FOR CONSTRUCTION PROJECTS**

**STATE CONSTRUCTION OFFICE  
NORTH CAROLINA  
DEPARTMENT OF ADMINISTRATION**

**Form OC-15**

**This document is intended for use on State capital construction projects and shall not be used on any project that is not reviewed and approved by the State Construction Office. Extensive modification to the General Conditions by means of “Supplementary General Conditions” is strongly discouraged. State agencies and institutions may include special requirements in “Division 1 – General Requirements” of the specifications, where they do not conflict with the General Conditions.**

**Twenty Fourth Edition January 2013  
Revision 1 - May 2024: Article 23.b**

## INSTRUCTIONS TO BIDDERS

**For a proposal to be considered it must be in accordance with the following instructions:**

### 1. PROPOSALS

Proposals must be made in strict accordance with the Form of Proposal provided therefor, and all blank spaces for bids, alternates, and unit prices applicable to bidder's work shall be properly filled in. When requested alternates are not bid, the proposer shall so indicate by the words "No Bid". Any blanks shall also be interpreted as "No Bid". The bidder agrees that bid on Form of Proposal detached from specifications will be considered and will have the same force and effect as if attached thereto. Photocopied or faxed proposals will not be considered. Numbers shall be stated both in writing and in figures for the base bids and alternates. If figures and writing differ, the written number will supersede the figures.

Any modifications to the Form of Proposal (including alternates and/or unit prices) will disqualify the bid and may cause the bid to be rejected.

The bidder shall fill in the Form of Proposal as follows:

- a. If the documents are executed by a sole owner, that fact shall be evidenced by the word "Owner" appearing after the name of the person executing them.
- b. If the documents are executed by a partnership, that fact shall be evidenced by the word "Co-Partner" appearing after the name of the partner executing them.
- c. If the documents are executed on the part of a corporation, they shall be executed by either the president or the vice president and attested by the secretary or assistant secretary in either case, and the title of the office of such persons shall appear after their signatures. The seal of the corporation shall be impressed on each signature page of the documents.
- d. If the proposal is made by a joint venture, it shall be executed by each member of the joint venture in the above form for sole owner, partnership or corporation, whichever form is applicable.
- e. All signatures shall be properly witnessed.
- f. If the contractor's license of a bidder is held by a person other than an owner, partner or officer of a firm, then the licensee shall also sign and be a party to the proposal. The title "Licensee" shall appear under his/her signature.

Proposals should be addressed as indicated in the Advertisement for Bids and be delivered, enclosed in an opaque sealed envelope, marked "Proposal" and bearing the title of the work, name of the bidder, and the contractor's license number of the bidder. Bidders should clearly mark on the outside of the bid envelope which contract(s) they are bidding.

Bidder shall identify on the bid, the minority businesses that will be utilized on the project with corresponding total dollar value of the bid and affidavit listing good faith efforts or an affidavit indicating work under contract will be self-performed, as required by G.S. 143-128.2(c) and G.S. 143-128.2(f). Failure to comply with these requirements is grounds for rejection of the bid.

For projects bid in the single-prime alternative, the names and license numbers of major subcontractors shall be listed on the proposal form.

It shall be the specific responsibility of the bidder to deliver his bid to the proper official at the selected place and prior to the announced time for the opening of bids. Later delivery of a bid for any reason, including delivery by any delivery service, shall disqualify the bid.

Unit prices quoted in the proposal shall include overhead and profit and shall be the full compensation for the contractor's cost involved in the work. See General Conditions, Article 19c-1.

## **2. EXAMINATION OF CONDITIONS**

It is understood and mutually agreed that by submitting a bid the bidder acknowledges that he has carefully examined all documents pertaining to the work, the location, accessibility and general character of the site of the work and all existing buildings and structures within and adjacent to the site, and has satisfied himself as to the nature of the work, the condition of existing buildings and structures, the conformation of the ground, the character, quality and quantity of the material to be encountered, the character of the equipment, machinery, plant and any other facilities needed preliminary to and during prosecution of the work, the general and local conditions, the construction hazards, and all other matters, including, but not limited to, the labor situation which can in any way affect the work under the contract, and including all safety measures required by the Occupational Safety and Health Act of 1970 and all rules and regulations issued pursuant thereto. It is further mutually agreed that by submitting a proposal the bidder acknowledges that he has satisfied himself as to the feasibility and meaning of the plans, drawings, specifications and other contract documents for the construction of the work and that he accepts all the terms, conditions and stipulations contained therein; and that he is prepared to work in cooperation with other contractors performing work on the site.

Reference is made to contract documents for the identification of those surveys and investigation reports of subsurface or latent physical conditions at the site or otherwise affecting performance of the work which have been relied upon by the designer in preparing the documents. The owner will make copies of all such surveys and reports available to the bidder upon request.

Each bidder may, at his own expense, make such additional surveys and investigations as he may deem necessary to determine his bid price for the performance of the work. Any on-site investigation shall be done at the convenience of the owner. Any reasonable request for access to the site will be honored by the owner.

## **3. BULLETINS AND ADDENDA**

Any addenda to specifications issued during the time of bidding are to be considered covered in the proposal and in closing a contract they will become a part thereof. It shall be the bidder's responsibility to ascertain prior to bid time the addenda issued and to see that his bid includes any changes thereby required.

Should the bidder find discrepancies in, or omission from, the drawings or documents or should he be in doubt as to their meaning, he shall at once notify the designer who will send written instructions in the form of addenda to all bidders. Notification should be no later than seven (7) days prior to the date set for receipt of bids. Neither the owner nor the designer will be responsible for any oral instructions.

All addenda should be acknowledged by the bidder(s) on the Form of Proposal. However, even if not acknowledged, by submitting a bid, the bidder has certified that he has reviewed all issued addenda and has included all costs associated within his bid.

#### **4. BID SECURITY**

Each proposal shall be accompanied by a cash deposit or a certified check drawn on some bank or trust company insured by the Federal Deposit Insurance Corporation, or a bid bond in an amount equal to not less than five percent (5%) of the proposal, said deposit to be retained by the owner as liquidated damages in event of failure of the successful bidder to execute the contract within ten (10) days after the award or to give satisfactory surety as required by law (G.S. 143-129).

Bid bond shall be conditioned that the surety will, upon demand, forthwith make payment to the obligee upon said bond if the bidder fails to execute the contract. The owner may retain bid securities of any bidder(s) who may have a reasonable chance of award of contract for the full duration of time stated in the Notice to Bidders. Other bid securities may be released sooner, at the discretion of the owner. All bid securities (cash or certified checks) shall be returned to the bidders promptly after award of contracts, and no later than seven (7) days after expiration of the holding period stated in the Notice to Bidders. Standard Form of Bid Bond is included in these specifications and shall be used.

#### **5. RECEIPT OF BIDS**

Bids shall be received in strict accordance with requirements of the General Statutes of North Carolina. Bid security shall be required as prescribed by statute. Prior to the closing of the bid, the bidder will be permitted to change or withdraw his bid. Guidelines for opening of public construction bids are available from the State Construction Office.

#### **6. OPENING OF BIDS**

Upon opening, all bids shall be read aloud. Once bidding is closed, there shall not be any withdrawal of bids by any bidder and no bids may be returned by the designer to any bidder. After the opening of bids, no bid may be withdrawn, except under the provisions of General Statute 143-129.1, for a period of thirty days unless otherwise specified. Should the successful bidder default and fail to execute a contract, the contract may be awarded to the next lowest and responsible bidder. The owner reserves the unqualified right to reject any and all bids. Reasons for rejection may include, but shall not be limited to, the following:

- a. If the Form of Proposal furnished to the bidder is not used or is altered.
- b. If the bidder fails to insert a price for all bid items, alternate and unit prices requested.
- c. If the bidder adds any provisions reserving the right to accept or reject any award.
- d. If there are unauthorized additions or conditional bids, or irregularities of any kind which tend to make the proposal incomplete, indefinite or ambiguous as to its meaning.
- e. If the bidder fails to complete the proposal form where information is requested so the bid may be properly evaluated by the owner.
- f. If the unit prices contained in the bid schedule are unacceptable to the owner and the State Construction Office.
- g. If the bidder fails to comply with other instructions stated herein.

## **7. BID EVALUATION**

The award of the contract will be made to the lowest responsible bidder as soon as practical. The owner may award on the basis of the base bid and any alternates the owner chooses.

Before awarding a contract, the owner may require the apparent low bidder to qualify himself to be a responsible bidder by furnishing any or all of the following data:

- a. The latest financial statement showing assets and liabilities of the company or other information satisfactory to the owner.
- b. A listing of completed projects of similar size.
- c. Permanent name and address of place of business.
- d. The number of regular employees of the organization and length of time the organization has been in business under present name.
- e. The name and home office address of the surety proposed and the name and address of the responsible local claim agent.
- f. The names of members of the firms who hold appropriate trade licenses, together with license numbers.
- g. If prequalified, contractor info will be reviewed and evaluated comparatively to submitted prequalification package.

Failure or refusal to furnish any of the above information, if requested, shall constitute a basis for disqualification of any bidder.

In determining the lowest responsible, responsive bidder, the owner shall take into consideration the bidder's compliance with the requirements of G.S. 143-128.2(c), the past performance of the bidder on construction contracts for the State with particular concern given to completion times, quality of work, cooperation with other contractors, and cooperation with the designer and owner. Failure of the low bidder to furnish affidavit and/or documentation as required by G.S. 143-128.2(c) shall constitute a basis for disqualification of the bid.

Should the owner adjudge that the apparent low bidder is not the lowest responsible, responsive bidder by virtue of the above information, said apparent low bidder will be so notified and his bid security shall be returned to him.

## **8. PERFORMANCE BOND**

The successful bidder, upon award of contract, shall furnish a performance bond in an amount equal to 100 percent of the contract price. See Article 35, General Conditions.

## **9. PAYMENT BOND**

The successful bidder, upon award of contract, shall furnish a payment bond in an amount equal to 100 percent of the contract price. See Article 35, General Conditions.

## **10. PAYMENTS**

Payments to the successful bidders (contractors) will be made on the basis of monthly estimates. See Article 31, General Conditions.

## **11. PRE-BID CONFERENCE**

Prior to the date set for receiving bids, the Designer may arrange and conduct a Pre-Bid Conference for all prospective bidders. The purpose of this conference is to review project requirements and to respond to questions from prospective bidders and their subcontractors or material suppliers related to the intent of bid documents. Attendance by prospective bidders shall be as required by the "Notice to Bidders".

## **12. SUBSTITUTIONS**

In accordance with the provisions of G.S. 133-3, material, product, or equipment substitutions proposed by the bidders to those specified herein can only be considered during the bidding phase until ten (10) days prior to the receipt of bids when submitted to the Designer with sufficient data to confirm material, product, or equipment equality. Proposed substitutions submitted after this time will be considered only as potential change order.

Submittals for proposed substitutions shall include the following information:

- a. Name, address, and telephone number of manufacturer and supplier as appropriate.
- b. Trade name, model or catalog designation.
- c. Product data including performance and test data, reference standards, and technical descriptions of material, product, or equipment. Include color samples and samples of available finishes as appropriate.
- d. Detailed comparison with specified products including performance capabilities, warranties, and test results.
- e. Other pertinent data including data requested by the Designer to confirm product equality.

If a proposed material, product, or equipment substitution is deemed equal by the Designer to those specified, all bidders of record will be notified by Addendum.

## GENERAL CONDITIONS OF THE CONTRACT

The use or reproduction of this document or any part thereof is authorized for and limited to use on projects of the State of North Carolina, and is distributed by, through and at the discretion of the State Construction Office, Raleigh, North Carolina, for that distinct and sole purpose.

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## ARTICLE 1 - DEFINITIONS

- a. The **contract documents** consist of the Notice to Bidders; Instructions to Bidders; General Conditions of the Contract; special conditions if applicable; Supplementary General Conditions; the drawing and specifications, including all bulletins, addenda or other modifications of the drawings and specifications incorporated into the documents prior to their execution; the proposal; the contract; the performance bond; the payment bond; insurance certificates; the approval of the attorney general; and the certificate of the Office of State Budget and Management. All of these items together form the contract.
- b. The **owner** is the State of North Carolina through the agency named in the contract.
- c. The **designer(s)** are those referred to within this contract, or their authorized representatives. The Designer(s), as referred to herein, shall mean architect and/or engineer. They will be referred to hereinafter as if each were of the singular number, masculine gender.
- d. The **contractor**, as referred to hereinafter, shall be deemed to be either of the several contracting parties called the "Party of the First Part" in either of the several contracts in connection with the total project. Where, in special instances hereinafter, a particular contractor is intended, an adjective precedes the word "contractor," as "general," "heating," etc. For the purposes of a single prime contract, the term Contractor shall be deemed to be the single contracting entity identified as the "Party of the First Part" in the single Construction Contract. Any references or adjectives that name or infer multiple prime contractors shall be interpreted to mean the single prime Contractor.
- e. A **subcontractor**, as the term is used herein, shall be understood to be one who has entered into a direct contract with a contractor, and includes one who furnishes materials worked to a special design in accordance with plans and specifications covered by the contract, but does not include one who only sells or furnishes materials not requiring work so described or detailed.
- f. **Written notice** shall be defined as notice in writing delivered in person to the contractor, or to a partner of the firm in the case of a partnership, or to a member of the contracting organization, or to an officer of the organization in the case of a corporation, or sent to the last known business address of the contracting organization by registered mail.
- g. **Work**, as used herein as a noun, is intended to include materials, labor, and workmanship of the appropriate contractor.
- h. The **project** is the total construction work to be performed under the contract documents by the several contractors.
- i. **Project Expediter**, as used herein, is an entity stated in the contract documents, designated to effectively facilitate scheduling and coordination of work activities. See Article 14(f) for responsibilities of a Project Expediter. **For the purposes of a single prime contract, the single prime contractor shall be designated as the Project Expediter.**
- j. **Change order**, as used herein, shall mean a written order to the contractor subsequent to the signing of the contract authorizing a change in the contract. The change order shall be signed by the contractor, designer and the owner, and approved by the State Construction Office, in that order (Article 19).

- k. **Field Order**, as used herein, shall mean a written approval for the contractor to proceed with the work requested by owner prior to issuance of a formal Change Order. The field order shall be signed by the contractor, designer, owner, and State Construction Office.
- l. **Time of completion**, as stated in the contract documents, is to be interpreted as consecutive calendar days measured from the date established in the written Notice to Proceed, or such other date as may be established herein (Article 23).
- m. **Liquidated damages**, as stated in the contract documents [, is an amount reasonably estimated in advance to cover the consequential damages associated with the Owner's economic loss in not being able to use the Project for its intended purposes at the end of the contract's completion date as amended by change order, if any, by reason of failure of the contractor(s) to complete the work within the time specified. Liquidated damages does not include the Owner's extended contract administration costs (including but not limited to additional fees for architectural and engineering services, testing services, inspection services, commissioning services, etc.), such other damages directly resulting from delays caused solely by the contractor, or consequential damages that the Owner identified in the bid documents that may be impacted by any delay caused solely by the Contractor (e.g., if a multi-phased project-subsequent phases, delays in start other projects that are dependent on the completion of this Project, extension of leases and/or maintenance agreements for other facilities).
- n. **Surety**, as used herein, shall mean the bonding company or corporate body which is bound with and for the contractor, and which engages to be responsible for the contractor and his acceptable performance of the work.
- o. **Routine written communications between the Designer and the Contractor** are any communication other than a "request for information" provided in letter, memo, or transmittal format, sent by mail, courier, electronic mail, or facsimile. Such communications can not be identified as "request for information".
- p. **Clarification or Request for information (RFI)** is a request from the Contractor seeking an interpretation or clarification by the Designer relative to the contract documents. The RFI, which shall be labeled (RFI), shall clearly and concisely set forth the issue or item requiring clarification or interpretation and why the response is needed. The RFI must set forth the Contractor's interpretation or understanding of the contract documents requirements in question, along with reasons for such an understanding.
- q. **Approval** means written or imprinted acknowledgement that materials, equipment or methods of construction are acceptable for use in the work.
- r. **Inspection** shall mean examination or observation of work completed or in progress to determine its compliance with contract documents.
- s. **"Equal to" or "approved equal"** shall mean materials, products, equipment, assemblies, or installation methods considered equal by the bidder in all characteristics (physical, functional, and aesthetic) to those specified in the contract documents. Acceptance of equal is subject to approval of Designer and owner.
- t. **"Substitution" or "substitute"** shall mean materials, products, equipment, assemblies, or installation methods deviating in at least one characteristic (physical, functional, or aesthetic) from those specified, but which in the opinion of the bidder would improve competition and/or enhance the finished installation. Acceptance of substitution is subject to the approval of the Designer and owner.

- u. **Provide** shall mean furnish and install complete in place, new, clean, operational, and ready for use.
- v. **Indicated and shown** shall mean provide as detailed, or called for, and reasonably implied in the contract documents.
- w. **Special inspector** is one who inspects materials, installation, fabrication, erection or placement of components and connections requiring special expertise to ensure compliance with the approved construction documents and referenced standards.
- x. **Commissioning** is a quality assurance process that verifies and documents that building components and systems operate in accordance to the owner's project requirements and the project design documents.
- y. **Designer Final Inspection** is the inspection performed by the design team to determine the completeness of the project in accordance with approved plans and specifications. This inspection occurs prior to SCO final inspection.
- z. **SCO Final Inspection** is the inspection performed by the State Construction Office to determine the completeness of the project in accordance with NC Building Codes and approved plans and specifications.
- aa. **Beneficial Occupancy** is requested by the owner and is occupancy or partial occupancy of the building after all life safety items have been completed as determined by the State Construction Office. Life safety items include but not limited to fire alarm, sprinkler, egress and exit lighting, fire rated walls, egress paths and security.
- bb. Final Acceptance is the date in which the State Construction Office accepts the construction as totally complete. This includes the SCO Final Inspection and certification by the designer that all punch lists are completed.

## ARTICLE 2 - INTENT AND EXECUTION OF DOCUMENTS

- a. The drawings and specifications are complementary, one to the other, and that which is shown on the drawings or called for in the specifications shall be as binding as if it were both called for and shown. The intent of the drawings and specifications is to establish the scope of all labor, materials, transportation, equipment, and any and all other things necessary to provide a bid for a complete job. In case of discrepancy or disagreement in the contract documents, the order of precedence shall be: Form of Contract, specifications, large-scale detail drawings, small-scale drawings.
- b. The wording of the specifications shall be interpreted in accordance with common usage of the language except that words having a commonly used technical or trade meaning shall be so interpreted in preference to other meanings.
- c. The contractor shall execute each copy of the proposal, contract, performance bond and payment bond as follows:
  - 1. If the documents are executed by a sole owner, that fact shall be evidenced by the word "Owner" appearing after the name of the person executing them.
  - 2. If the documents are executed by a partnership, that fact shall be evidenced by the word "Co-Partner" appearing after the name of the partner executing them.

3. If the documents are executed on the part of a corporation, they shall be executed by either the president or the vice president and attested by the secretary or assistant secretary in either case, and the title of the office of such persons shall appear after their signatures. The seal of the corporation shall be impressed on each signature page of the documents.
4. If the documents are made by a joint venture, they shall be executed by each member of the joint venture in the above form for sole owner, partnership or corporation, whichever form is applicable to each particular member.
5. All signatures shall be properly witnessed.
6. If the contractor's license is held by a person other than an owner, partner or officer of a firm, then the licensee shall also sign and be a party to the contract. The title "Licensee" shall appear under his/her signature.
7. The bonds shall be executed by an attorney-in-fact. There shall be attached to each copy of the bond a certified copy of power of attorney properly executed and dated.
8. Each copy of the bonds shall be countersigned by an authorized individual agent of the bonding company licensed to do business in North Carolina. The title "Licensed Resident Agent" shall appear after the signature.
9. The seal of the bonding company shall be impressed on each signature page of the bonds.
10. The contractor's signature on the performance bond and the payment bond shall correspond with that on the contract. The date of performance and payment bond shall not be prior to the date of the contract.

### **ARTICLE 3 - CLARIFICATIONS AND DETAIL DRAWINGS**

- a. In such cases where the nature of the work requires clarification by the designer, such clarification shall be furnished by the designer with reasonable promptness by means of written instructions or detail drawings, or both. Clarifications and drawings shall be consistent with the intent of contract documents, and shall become a part thereof.
- b. The contractor(s) and the designer shall prepare, if deemed necessary, a schedule fixing dates upon which foreseeable clarifications will be required. The schedule will be subject to addition or change in accordance with progress of the work. The designer shall furnish drawings or clarifications in accordance with that schedule. The contractor shall not proceed with the work without such detail drawings and/or written clarifications.

### **ARTICLE 4 - COPIES OF DRAWINGS AND SPECIFICATIONS**

The designer or Owner shall furnish free of charge to the contractors electronic copies of plans and specifications. If requested by the contractor, paper copies of plans and specifications shall be furnished free of charge as follows:

- a. General contractor - Up to twelve (12) sets of general contractor drawings and specifications, up to six (6) sets of which shall include drawings and specifications of all other contracts, plus a clean set of black line prints on white paper of all appropriate drawings, upon which the contractor shall clearly and legibly record all work-in-place that is at variance with the contract documents.

- b. Each other contractor - Up to six (6) sets of the appropriate drawings and specifications, up to three (3) sets of which shall include drawings and specifications of all other contracts, plus a clean set of black line prints on white paper of all appropriate drawings, upon which the contractor shall clearly and legibly record all work-in-place that is at variance with the contract documents.
- c. Additional sets shall be furnished at cost, including mailing, to the contractor upon request by the contractor. This cost shall be stated in the bidding documents.
- d. For the purposes of a single-prime contract, the contractor shall receive up to 30 sets of drawings and specifications, plus a clean set of black line prints on white paper of all appropriate drawings, upon which the contractor shall clearly and legibly record all work-in-place that is at variance with the contract documents.

#### **ARTICLE 5 - SHOP DRAWINGS, SUBMITTALS, SAMPLES, DATA**

- a. Within 15 consecutive calendar days after the notice to proceed, each prime contractor shall submit a schedule for submission of all shop drawings, product data, samples, and similar submittals through the Project Expediter to the Designer. This schedule shall indicate the items, relevant specification sections, other related submittal, data, and the date when these items will be furnished to the designer.
- b. The Contractor(s) shall review, approve and submit to the Designer all Shop Drawings, Coordination Drawings, Product Data, Samples, Color Charts, and similar submittal data required or reasonably implied by the Contract Documents. Required Submittals shall bear the Contractor's stamp of approval, any exceptions to the Contract Documents shall be noted on the submittals, and copies of all submittals shall be of sufficient quantity for the Designer to retain up to three (3) copies of each submittal for his own use plus additional copies as may be required by the Contractor. Submittals shall be presented to the Designer in accordance with the schedule submitted in paragraph (a). so as to cause no delay in the activities of the Owner or of separate Contractors.
- c. The Designer shall review required submittals promptly, noting desired corrections if any, and retaining three (3) copies (1 for the Designer, 1 for the owner and 1 for SCO) for his use. The remaining copies of each submittal shall be returned to the Contractor not later than twenty (20) days from the date of receipt by the Designer, for the Contractor's use or for corrections and resubmittal as noted by the Designer. When resubmittals are required, the submittal procedure shall be the same as for the original submittals.
- d. Approval of shop drawings/submittals by the Designer shall not be construed as relieving the Contractor from responsibility for compliance with the design or terms of the contract documents nor from responsibility of errors of any sort in the shop drawings, unless such lack of compliance or errors first have been called in writing to the attention of the Designer by the Contractor.

#### **ARTICLE 6 - WORKING DRAWINGS AND SPECIFICATIONS AT THE JOB SITE**

- a. The contractor shall maintain, in readable condition at his job office, one complete set of working drawings and specifications for his work including all shop drawings. Such drawings and specifications shall be available for use by the designer, his authorized representative, owner or State Construction Office.

- b. The contractor shall maintain at the job office, a day-to-day record of work-in-place that is at variance with the contract documents. Such variations shall be fully noted on project drawings by the contractor and submitted to the designer upon project completion and no later than 30 days after final acceptance of the project.
- c. The contractor shall maintain at the job office a record of all required tests that have been performed, clearly indicating the scope of work inspected and the date of approval or rejection.

## **ARTICLE 7 - OWNERSHIP OF DRAWINGS AND SPECIFICATIONS**

All drawings and specifications are instruments of service and remain the property of the owner. The use of these instruments on work other than this contract without permission of the owner is prohibited. All copies of drawings and specifications other than contract copies shall be returned to the owner upon request after completion of the work.

## **ARTICLE 8 - MATERIALS, EQUIPMENT, EMPLOYEES**

- a. The contractor shall, unless otherwise specified, supply and pay for all labor, transportation, materials, tools, apparatus, lights, power, heat, sanitary facilities, water, scaffolding and incidentals necessary for the completion of his work, and shall install, maintain and remove all equipment of the construction, other utensils or things, and be responsible for the safe, proper and lawful construction, maintenance and use of same, and shall construct in the best and most workmanlike manner, a complete job and everything incidental thereto, as shown on the plans, stated in the specifications, or reasonably implied therefrom, all in accordance with the contract documents.
- b. All materials shall be new and of quality specified, except where reclaimed material is authorized herein and approved for use. Workmanship shall at all times be of a grade accepted as the best practice of the particular trade involved, and as stipulated in written standards of recognized organizations or institutes of the respective trades except as exceeded or qualified by the specifications.
- c. Upon notice, the contractor shall furnish evidence as to quality of materials.
- d. Products are generally specified by ASTM or other reference standard and/or by manufacturer's name and model number or trade name. When specified only by reference standard, the Contractor may select any product meeting this standard, by any manufacturer. When several products or manufacturers are specified as being equally acceptable, the Contractor has the option of using any product and manufacturer combination listed. However, the contractor shall be aware that the cited examples are used only to denote the quality standard of product desired and that they do not restrict bidders to a specific brand, make, manufacturer or specific name; that they are used only to set forth and convey to bidders the general style, type, character and quality of product desired; and that equivalent products will be acceptable. Request for substitution of materials, items, or equipment shall be submitted to the designer for approval or disapproval; such approval or disapproval shall be made by the designer prior to the opening of bids. Alternate materials may be requested after the award if it can clearly be demonstrated that it is an added benefit to the owner and the designer and owner approves.
- e. The designer is the judge of equality for proposed substitution of products, materials or equipment.

- g. If at any time during the construction and completion of the work covered by these contract documents, the language, conduct, or attire of any workman of the various crafts be adjudged a nuisance to the owner or designer, or if any workman be considered detrimental to the work, the contractor shall order such parties removed immediately from grounds.

## **ARTICLE 9 - ROYALTIES, LICENSES AND PATENTS**

It is the intention of the contract documents that the work covered herein will not constitute in any way infringement of any patent whatsoever unless the fact of such patent is clearly evidenced herein. The contractor shall protect and save harmless the owner against suit on account of alleged or actual infringement. The contractor shall pay all royalties and/or license fees required on account of patented articles or processes, whether the patent rights are evidenced hereinafter.

## **ARTICLE 10 - PERMITS, INSPECTIONS, FEES, REGULATIONS**

- a. The contractor shall give all notices and comply with all laws, ordinances, codes, rules and regulations bearing on the conduct of the work under this contract. If the contractor observes that the drawings and specifications are at variance therewith, he shall promptly notify the designer in writing. See Instructions to Bidders, Paragraph 3, Bulletins and Addenda. Any necessary changes required after contract award shall be made by change order in accordance with Article 19. If the contractor performs any work knowing it to be contrary to such laws, ordinances, codes, rules and regulations, and without such notice to the designer, he shall bear all cost arising therefrom. Additional requirements implemented after bidding will be subject to equitable negotiations.
- b. All work under this contract shall conform to the North Carolina State Building Code and other State, local and national codes as are applicable. The cost of all required inspections and permits shall be the responsibility of the contractor and included within the bid proposal. All water taps, meter barrels, vaults and impact fees shall be paid by the contractor unless otherwise noted.
- d. Projects constructed by the State of North Carolina or by any agency or institution of the State are not subject to inspection by any county or municipal authorities and are not subject to county or municipal building codes. The contractor shall, however, cooperate with the county or municipal authorities by obtaining building permits. Permits shall be obtained at no cost.
- e. Projects involving local funding (community colleges) are subject also to county and municipal building codes and inspection by local authorities. The contractor shall pay the cost of these permits and inspections.



## ARTICLE 11 - PROTECTION OF WORK, PROPERTY AND THE PUBLIC

- a. The contractors shall be jointly responsible for the entire site and the building or construction of the same and provide all the necessary protections, as required by the owner or designer, and by laws or ordinances governing such conditions. They shall be responsible for any damage to the owner's property, or of that of others on the job, by them, their personnel, or their subcontractors, and shall make good such damages. They shall be responsible for and pay for any damages caused to the owner. All contractors shall have access to the project at all times.
- b. The contractor shall provide cover and protect all portions of the structure when the work is not in progress, provide and set all temporary roofs, covers for doorways, sash and windows, and all other materials necessary to protect all the work on the building, whether set by him, or any of the subcontractors. Any work damaged through the lack of proper protection or from any other cause, shall be repaired or replaced without extra cost to the owner.
- c. No fires of any kind will be allowed inside or around the operations during the course of construction without special permission from the designer and owner.
- d. The contractor shall protect all trees and shrubs designated to remain in the vicinity of the operations by building substantial boxes around same. He shall barricade all walks, roads, etc., as directed by the designer to keep the public away from the construction. All trenches, excavations or other hazards in the vicinity of the work shall be well barricaded and properly lighted at night.
- e. The contractor shall provide all necessary safety measures for the protection of all persons on the job, including the requirements of the A.G.C. *Accident Prevention Manual in Construction*, as amended, and shall fully comply with all state laws or regulations and North Carolina State Building Code requirements to prevent accident or injury to persons on or about the location of the work. He shall clearly mark or post signs warning of hazards existing, and shall barricade excavations, elevator shafts, stairwells and similar hazards. He shall protect against damage or injury resulting from falling materials and he shall maintain all protective devices and signs throughout the progress of the work.
- f. The contractor shall adhere to the rules, regulations and interpretations of the North Carolina Department of Labor relating to Occupational Safety and Health Standards for the Construction Industry (Title 29, Code of Federal Regulations, Part 1926, published in Volume 39, Number 122, Part II, June 24, 1974, *Federal Register*), and revisions thereto as adopted by General Statutes of North Carolina 95-126 through 155.
- g. The contractor shall designate a responsible person of his organization as safety officer/inspector to inspect the project site for unsafe health and safety hazards, to report these hazards to the contractor for correction, and whose duties also include accident prevention on the project, and to provide other safety and health measures on the project site as required by the terms and conditions of the contract. The name of the safety inspector shall be made known to the designer and owner at the time of the preconstruction conference and in all cases prior to any work starting on the project.
- h. In the event of emergency affecting the safety of life, the protection of work, or the safety of adjoining properties, the contractor is hereby authorized to act at his own discretion, without further authorization from anyone, to prevent such threatened injury or damage.

Any compensation claimed by the contractor on account of such action shall be determined as provided for under Article 19(b).

- i. Any and all costs associated with correcting damage caused to adjacent properties of the construction site or staging area shall be borne by the contractor. These costs shall include but not be limited to flooding, mud, sand, stone, debris, and discharging of waste products.

## **ARTICLE 12 - SEDIMENTATION POLLUTION CONTROL ACT OF 1973**

- a. Any land-disturbing activity performed by the contractor(s) in connection with the project shall comply with all erosion control measures set forth in the contract documents and any additional measures which may be required in order to ensure that the project is in full compliance with the Sedimentation Pollution Control Act of 1973, as implemented by Title 15, North Carolina Administrative Code, Chapter 4, Sedimentation Control, Subchapters 4A, 4B and 4C, as amended (15 N.C.A.C. 4A, 4B and 4C).
- b. Upon receipt of notice that a land-disturbing activity is in violation of said act, the contractor(s) shall be responsible for ensuring that all steps or actions necessary to bring the project in compliance with said act are promptly taken.
- c. The contractor(s) shall be responsible for defending any legal actions instituted pursuant to N.C.G.S. 113A-64 against any party or persons described in this article.
- d. To the fullest extent permitted by law, the contractor(s) shall indemnify and hold harmless the owner, the designer and the agents, consultants and employees of the owner and designer, from and against all claims, damages, civil penalties, losses and expenses, including, but not limited to, attorneys' fees, arising out of or resulting from the performance of work or failure of performance of work, provided that any such claim, damage, civil penalty, loss or expense is attributable to a violation of the Sedimentation Pollution Control Act. Such obligation shall not be construed to negate, abridge or otherwise reduced any other right or obligation of indemnity which would otherwise exist as to any party or persons described in this article.

## **ARTICLE 13 - INSPECTION OF THE WORK**

- a. It is a condition of this contract that the work shall be subject to inspection during normal working hours and during any time work is in preparation and progress by the designer, designated official representatives of the owner, State Construction Office and those persons required by state law to test special work for official approval. The contractor shall therefore provide safe access to the work at all times for such inspections.
- b. All instructions to the contractor will be made only by or through the designer or his designated project representative. Observations made by official representatives of the owner shall be conveyed to the designer for review and coordination prior to issuance to the contractor.
- c. All work shall be inspected by designer, special inspector and/or State Construction Office prior to being covered by the contractor. Contractor shall give a minimum two weeks notice unless otherwise agreed to by all parties. If inspection fails, after the first reinspection all costs associated with additional reinspections shall be borne by the contractor.

- d. Where special inspection or testing is required by virtue of any state laws, instructions of the designer, specifications or codes, the contractor shall give adequate notice to the designer of the time set for such inspection or test, if the inspection or test will be conducted by a party other than the designer. Such special tests or inspections will be made in the presence of the designer, or his authorized representative, and it shall be the contractor's responsibility to serve ample notice of such tests.
- e. All laboratory tests shall be paid by the owner unless provided otherwise in the contract documents except the general contractor shall pay for laboratory tests to establish design mix for concrete, and for additional tests to prove compliance with contract documents where materials have tested deficient except when the testing laboratory did not follow the appropriate ASTM testing procedures.
- f. Should any work be covered up or concealed prior to inspection and approval by the designer, special inspector, and/or State Construction Office such work shall be uncovered or exposed for inspection, if so requested by the designer in writing. Inspection of the work will be made upon notice from the contractor. All cost involved in uncovering, repairing, replacing, recovering and restoring to design condition, the work that has been covered or concealed will be paid by the contractor involved.

#### **ARTICLE 14 - CONSTRUCTION SUPERVISION AND SCHEDULE**

- a. Throughout the progress of the work, each contractor shall keep at the job site, a competent superintendent and supervisory staff satisfactory to the designer and the owner. The superintendent and supervisory staff shall not be changed without the consent of the designer and owner unless said superintendent ceases to be employed by the contractor or ceases to be competent as determined by the contractor, designer or owner. The superintendent and other staff designated by the contractor in writing shall have authority to act on behalf of the contractor, and instructions, directions or notices given to him shall be as binding as if given to the contractor. However, directions, instructions, and notices shall be confirmed in writing.
- b. The contractor shall examine and study the drawings and specifications and fully understand the project design, and shall provide constant and efficient supervision to the work. Should he discover any discrepancies of any sort in the drawings or specifications, he shall report them to the designer without delay. He will not be held responsible for discrepancies in the drawings and/or specifications, but shall be held responsible to report them should they become known to him.
- c. All contractors shall be required to cooperate and consult with each other during the construction of this project. Prior to installation of work, all contractors shall jointly prepare coordination drawings, showing locations of various ductworks, piping, motors, pumps, and other mechanical or electrical equipment, in relation to the structure, walls and ceilings. These drawings shall be submitted to the designer through the Project Expediter for information only. Each contractor shall lay out and execute his work to cause the least delay to other contractors. Each contractor shall be financially responsible for any damage to other contractor's work and for undue delay caused to other contractors on the project.
- d. The contractor is required to attend job site progress conferences as called by the designer. The contractor shall be represented at these job progress conferences by both home office and project personnel. These representatives shall have authority to act on behalf of the contractor. These meetings shall be open to subcontractors, material

suppliers and any others who can contribute toward maintaining required job progress. It shall be the principal purpose of these meetings, or conferences, to effect coordination, cooperation and assistance in every practical way toward the end of maintaining progress of the project on schedule and to complete the project within the specified contract time. Each contractor shall be prepared to assess progress of the work as required in his particular contract and to recommend remedial measures for correction of progress as may be appropriate. The designer or his authorized representative shall be the coordinator of the conferences and shall preside as chairman. The contractor shall turn over a copy of his daily reports to the Designer and Owner at the job site progress conference. Owner will determine daily report format.

- e The contractor(s) shall, employ an engineer or a land surveyor licensed in the State of North Carolina to lay out the work and to establish a bench mark in a location where same will not be disturbed and where direct instruments sights may be taken.
- f. The designer shall designate a Project Expediter on projects involving two or more prime contracts. The Project Expediter shall be designated in the Supplementary General Conditions. The Project Expediter shall have at a minimum the following responsibilities.
  - 1. Prepare the project construction schedule and shall allow all prime contractors (multi-prime contract) and subcontractors (single-prime contract) performing general, plumbing, HVAC, and electrical work equal input into the preparation of the initial construction schedule.
  - 2. Maintain a project progress schedule for all contractors.
  - 3. Give adequate notice to all contractors to ensure efficient continuity of all phases of the work.
  - 4. Notify the designer of any changes in the project schedule.
  - 5. Recommend to the owner whether payment to a contractor shall be approved.
- g. It shall be the responsibility of the Project Expediter to cooperate with and obtain from several prime contractors and subcontractors on the job, their respective work activities and integrate these activities into a project construction schedule in form of a detailed bar chart or Critical Path Method (CPM), schedule. Each prime contractor shall provide work activities within fourteen (14) days of request by the Project Expediter. A “work activity”, for scheduling purposes, shall be any component or contractual requirement of the project requiring at least one (1) day, but not more than fourteen (14) days, to complete or fulfill. The project construction schedule shall graphically show all salient features of the work required to construct the project from start to finish and within the allotted time established in the contract. The time (in days) between the contractor’s early completion and contractual completion dates is part of the project total float time; and shall be used as such, unless amended by a change order. On a multi-prime project, each prime contractor shall review the proposed construction schedule and approve same in writing. The Project Expediter shall submit the proposed construction schedule to the designer for comments. The complete Project construction schedule shall be of the type set forth in the Supplementary General Condition or subparagraph (1) or (2) below, as appropriate:

1. For a project with total contracts of \$500,000 or less, a bar chart schedule will satisfy the above requirement. The schedule shall indicate the estimated starting and completion dates for each major element of the work.
2. For a project with total contracts over \$500,000, a Critical Path Method (CPM) schedule shall be utilized to control the planning and scheduling of the Work. The CPM schedule shall be the responsibility of the Project Expediter and shall be paid for by the Project Expediter.

**Bar Chart Schedule:** Where a bar chart schedule is required, it shall be time-scaled in weekly increments, shall indicate the estimated starting and completion dates for each major element of the work by trade and by area, level, or zone, and shall schedule dates for all salient features, including but not limited to the placing of orders for materials, submission of shop drawings and other Submittals for approval, approval of shop drawings by designers, the manufacture and delivery of material, the testing and the installation of materials, supplies and equipment, and all Work activities to be performed by the Contractor. The Contractor shall allow sufficient time in his schedule for all commissioning, required inspections and completion of final punchlist(s). Each Work activity will be assigned a time estimate by the Contractor. One day shall be the smallest time unit used.

**CPM Schedule:** Where a CPM schedule is required, it shall be in time-scaled precedence format using the Project Expediter's logic and time estimates. The CPM schedule shall be drawn or plotted with activities grouped or zoned by Work area or subcontract as opposed to a random (or scattered) format. The CPM schedule shall be time-scaled on a weekly basis and shall be drawn or plotted at a level of detail and logic which will schedule all salient features of the work to be performed by the Contractor. The Contractor shall allow sufficient time in his schedule for all commissioning, required inspections and completion of final punchlist(s).. Each Work activity will be assigned a time estimate by the Contractor. One day shall be the smallest time unit used.

The CPM schedule will identify and describe each activity, state the duration of each activity, the calendar dates for the early and late start and the early and late finish of each activity, and clearly highlight all activities on the critical path. "Total float" and "free float" shall be indicated for all activities. Float time shall not be considered for the exclusive use or benefit of either the Owner or the Contractor, but must be allocated in the best interest of completing the Work within the Contract time. Extensions to the Contract time, when granted by Change Order, will be granted only when equitable time adjustment exceeds the Total Float in the activity or path of activities affected by the change. On contracts with a price over \$2,500,000, the CPM schedule shall also show what part of the Contract Price is attributable to each activity on the schedule, the sum of which for all activities shall equal the total Contract Price.

**Early Completion of Project:** The Contractor may attempt to complete the project prior to the Contract Completion Date. However, such planned early completion shall be for the Contractor's convenience only and shall not create any additional rights of the Contractor or obligations of the Owner under this Contract, nor shall it change the Time

for Completion or the Contract Completion Date. The Contractor shall not be required to pay liquidated damages to the Owner because of its failure to complete by its planned earlier date. Likewise, the Owner shall not pay the Contractor any additional compensation for early completion nor will the Owner owe the Contractor any compensation should the Owner, its officers, employees, or agents cause the Contractor not to complete earlier than the date required by the Contract Documents.

- h. The proposed project construction schedule shall be presented to the designer no later than fifteen (15) days after written notice to proceed. No application for payment will be processed until this schedule is accepted by the designer and owner.
- i. The approved project construction schedule shall be distributed to all contractors and displayed at the job site by the Project Expediter.
- j. The several contractors shall be responsible for their work activities and shall notify the Project Expediter of any necessary changes or adjustments to their work. The Project Expediter shall maintain the project construction schedule, making biweekly adjustments, updates, corrections, etc., that are necessary to finish the project within the Contract time, keeping all contractors and the designer fully informed. Copy of a bar chart schedule annotated to show the current progress shall be submitted by the Contractor(s) to the designer, along with monthly request for payment. For project requiring CPM schedule, the Contractor shall submit a biweekly report of the status of all activities. The bar chart schedule or status report shall show the actual Work completed to date in comparison with the original Work scheduled for all activities. If any activities of the work of several contractors are behind schedule, the contractor must indicate in writing, what measures will be taken to bring each such activity back on schedule and to ensure that the Contract Completion Date is not exceeded. A plan of action and recovery schedule shall be developed and submitted to the designer by the Project Expediter, when (1) the contractor's report indicates delays, that are in the opinion of the designer or the owner, of sufficient magnitude that the contractor's ability to complete the work by the scheduled completion is brought into question; (2) the updated construction schedule is thirty (30) days behind the planned or baseline schedule and no legitimate time extensions, as determined by the Designer, are in process; and (3) the contractor desires to make changes in the logic (sequencing of work) or the planned duration of future activities of the CPM schedule which, in the opinion of the designer or the owner, are of a major nature. The plan of action, when required shall be submitted to the Owner for review within two (2) business days of the Contractor receiving the Owner's written demand. The recovery schedule, when required, shall be submitted to the Owner within five (5) calendar days of the Contractor's receiving the Owner's written demand. Failure to provide an updated construction schedule or a recovery schedule may be grounds for rejection of payment applications or withholding of funds as set forth in Article 33.
- k. The Project Expediter shall notify each contractor of such events or time frames that are critical to the progress of the job. Such notice shall be timely and reasonable. Should the progress be delayed due to the work of any of the several contractors, it shall be the duty of the Project Expediter to immediately notify the contractor(s) responsible for such delay, the designer, the State Construction Office and other prime contractors. The designer shall determine the contractor(s) who caused the delays and notify the bonding company of the responsible contractor(s) of the delays; and shall make a recommendation to the owner regarding further action.
- l. Designation as Project Expediter entails an additional project control responsibility and does not alter in any way the responsibility of the contractor so designated, nor the

responsibility of the other contractors involved in the project. The project expeditor's Superintendent(s) shall be in attendance at the Project site at all times when work is in progress unless conditions are beyond the control of the Contractor or until termination of the Contract in accordance with the Contract Documents. It is understood that such Superintendent shall be acceptable to the Owner and Designer and shall be the one who will be continued in that capacity for the duration of the project unless he ceases to be on the Contractor's payroll or the Owner otherwise agrees. The Superintendent shall not be employed on any other project for or by the Contractor or by any other entity during the course of the Work. If the Superintendent is employed by the Contractor on another project without the Owner's approval, then the Owner may deduct from the Contractor's monthly general condition costs and amount representing the Superintendent's cost and shall deduct that amount for each month thereafter until the Contractor has the Superintendent back on the Owner's Project full-time.

## **ARTICLE 15 - SEPARATE CONTRACTS AND CONTRACTOR RELATIONSHIPS**

- a. Effective from January 1, 2002, Chapter 143, Article 8, was amended, to allow public contracts to be delivered by the following delivery methods: single-prime, dual (single-prime and separate-prime), construction manager at risk, and alternative contracting method as approved by the State Building Commission. The owner reserves the right to prepare separate specifications, receive separate bids, and award separate contracts for such other major items of work as may be in the best interest of the State. For the purposes of a single prime contract, refer to Article 1 – Definitions.
- b. All contractors shall cooperate with each other in the execution of their work, and shall plan their work in such manner as to avoid conflicting schedules or delay of the work. See Article 14, Construction Supervision.
- c. If any part of contractor's work depends upon the work of another contractor, defects which may affect that work shall be reported to the designer in order that prompt inspection may be made and the defects corrected. Commencement of work by a contractor where such condition exists will constitute acceptance of the other contractor's work as being satisfactory in all respects to receive the work commenced, except as to defects which may later develop. The designer shall be the judge as to the quality of work and shall settle all disputes on the matter between contractors.
- d. Any mechanical or electrical work such as sleeves, inserts, chases, openings, penetrations, etc., which is located in the work of the general contractor shall be built in by the general contractor. The respective mechanical and electrical contractors shall set all sleeves, inserts and other devices that are to be incorporated into the structure in cooperation and under the supervision of the general contractor. The responsibility for the exact location of such items shall be that of the mechanical and/or electrical contractor.
- e. The designer and the owner shall have access to the work whenever it is in preparation and progress and during normal working hours. The contractor shall provide facilities for such access so the designer may perform his functions under the contract documents.
- f. Should a contractor cause damage to the work or property of another contractor, he shall be directly responsible, and upon notice, shall promptly settle the claim or otherwise resolve the dispute.

## **ARTICLE 16 - SUBCONTRACTS AND SUBCONTRACTORS**

- a. Within thirty (30) days after award of the contract, the contractor shall submit to the designer, owner and to the State Construction Office a list giving the names and addresses of subcontractors and equipment and material suppliers he proposes to use, together with the scope of their respective parts of the work. Should any subcontractor be disapproved by the designer or owner, the designer or owner shall submit his reasons for disapproval in writing to the State Construction Office for its consideration with a copy to the contractor. If the State Construction Office concurs with the designer's or owner's recommendation, the contractor shall submit a substitute for approval. The designer and owner shall act promptly in the approval of subcontractors, and when approval of the list is given, no changes of subcontractors will be permitted except for cause or reason considered justifiable by the designer or owner.
- b. The designer will furnish to any subcontractor, upon request, evidence regarding amounts of money paid to the contractor on account of the subcontractor's work.
- c. The contractor is and remains fully responsible for his own acts or omissions as well as those of any subcontractor or of any employee of either. The contractor agrees that no contractual relationship exists between the subcontractor and the owner in regard to the contract, and that the subcontractor acts on this work as an agent or employee of the contractor.
- d. The owner reserves the right to limit the amount of portions of work to be subcontracted as hereinafter specified.

## **ARTICLE 17 - CONTRACTOR AND SUBCONTRACTOR RELATIONSHIPS**

The contractor agrees that the terms of these contract documents shall apply equally to each subcontractor as to the contractor, and the contractor agrees to take such action as may be necessary to bind each subcontractor to these terms. The contractor further agrees to conform to the Code of Ethical Conduct as adopted by the Associated General Contractors of America, Inc., with respect to contractor-subcontractor relationships, and that payments to subcontractors shall be made in accordance with the provisions of G.S. 143-134.1 titled Interest on final payments due to prime contractors: payments to subcontractors.

- a. On all public construction contracts which are let by a board or governing body of the state government or any political subdivision thereof, except contracts let by the Department of Transportation pursuant to G.S. 136-28.1, the balance due prime contractors shall be paid in full within 45 days after respective prime contracts of the project have been accepted by the owner, certified by the architect, engineer or designer to be completed in accordance with terms of the plans and specifications, or occupied by the owner and used for the purpose for which the project was constructed, whichever occurs first. Provided, however, that whenever the architect or consulting engineer in charge of the project determines that delay in completion of the project in accordance with terms of the plans and specifications is the fault of the contractor, the project may be occupied and used for the purposes for which it was constructed without payment of any interest on amounts withheld past the 45 day limit. No payment shall be delayed because of the failure of another prime contractor on such project to complete his contract. Should final payment to any prime contractor beyond the date such contracts have been certified to be completed by the designer or architect, accepted by the owner, or occupied by the owner and used for the purposes for which the project was constructed, be delayed by more than 45 days, said prime contractor shall be paid interest, beginning on the 46th day, at the rate of one percent (1%) per month or fraction thereof unless a lower rate is



agreed upon on such unpaid balance as may be due. In addition to the above final payment provisions, periodic payments due a prime contractor during construction shall be paid in accordance with the payment provisions of the contract documents or said prime contractor shall be paid interest on any such unpaid amount at the rate stipulated above for delayed final payments. Such interest shall begin on the date the payment is due and continue until the date on which payment is made. Such due date may be established by the terms of the contract. Funds for payment of such interest on state-owned projects shall be obtained from the current budget of the owning department, institution or agency. Where a conditional acceptance of a contract exists, and where the owner is retaining a reasonable sum pending correction of such conditions, interest on such reasonable sum shall not apply.

- b. Within seven days of receipt by the prime contractor of each periodic or final payment, the prime contractor shall pay the subcontractor based on work completed or service provided under the subcontract. Should any periodic or final payment to the subcontractor be delayed by more than seven days after receipt of periodic or final payment by the prime contractor, the prime contractor shall pay the subcontractor interest, beginning on the eighth day, at the rate of one percent (1%) per month or fraction thereof on such unpaid balance as may be due.
- c. The percentage of retainage on payments made by the prime contractor to the subcontractor shall not exceed the percentage of retainage on payments made by the owner to the prime contractor. Any percentage of retainage on payments made by the prime contractor to the subcontractor that exceeds the percentage of retainage on payments made by the owner to the prime contractor shall be subject to interest to be paid by the prime contractor to the subcontractor at the rate of one percent (1%) per month or fraction thereof.
- d. Nothing in this section shall prevent the prime contractor at the time of application and certification to the owner from withholding application and certification to the owner for payment to the subcontractor for unsatisfactory job progress; defective construction not remedied; disputed work; third-party claims filed or reasonable evidence that claim will be filed; failure of subcontractor to make timely payments for labor, equipment and materials; damage to prime contractor or another subcontractor; reasonable evidence that subcontract cannot be completed for the unpaid balance of the subcontract sum; or a reasonable amount for retainage not to exceed the initial percentage retained by owner.

## **ARTICLE 18 - DESIGNER'S STATUS**

- a. The designer shall provide general administration of the performance of construction contracts, including liaison and necessary inspection of the work to ensure compliance with plans and specifications. He is the agent of the owner only for the purpose of constructing this work and to the extent stipulated in the contract documents. He has authority to direct work to be performed, to stop work, to order work removed, or to order corrections of faulty work, where any such action by the designer may be necessary to assure successful completion of the work.
- b. The designer is the impartial interpreter of the contract documents, and, as such, he shall exercise his powers under the contract to enforce faithful performance by both the owner and the contractor, taking sides with neither.
- c. Should the designer cease to be employed on the work for any reason whatsoever, then the owner shall employ a competent replacement who shall assume the status of the former designer.

- d. The designer and his consultants will make inspections of the project. He will inspect the progress, the quality and the quantity of the work.
- e. The designer and the owner shall have access to the work whenever it is in preparation and progress during normal working hours. The contractor shall provide facilities for such access so the designer and owner may perform their functions under the contract documents.
- f. Based on the designer's inspections and evaluations of the project, the designer shall issue interpretations, directives and decisions as may be necessary to administer the project. His decisions relating to artistic effect and technical matters shall be final, provided such decisions are within the limitations of the contract.

## **ARTICLE 19 - CHANGES IN THE WORK**

- a. The owner may have changes made in the work covered by the contract. These changes will not invalidate and will not relieve or release the contractor from any guarantee given by him pertinent to the contract provisions. These changes will not affect the validity of the guarantee bond and will not relieve the surety or sureties of said bond. All extra work shall be executed under conditions of the original contract.
- b. Except in an emergency endangering life or property, no change shall be made by the contractor except upon receipt of approved change order or written field order from the designer, countersigned by the owner and the state construction office authorizing such change. No claim for adjustments of the contract price shall be valid unless this procedure is followed.

A field order, transmitted by fax, electronically, or hand delivered, may be used where the change involved impacts the critical path of the work. A formal change order shall be issued as expeditiously as possible.

In the event of emergency endangering life or property, the contractor may be directed to proceed on a time and material basis whereupon the contractor shall proceed and keep accurately on such form as specified by the designer or owner, a correct account of costs together with all proper invoices, payrolls and supporting data. Upon completion of the work the change order will be prepared as outlined under either Method "c(1)" or Method "c(2)" or both.

- c. In determining the values of changes, either additive or deductive, contractors are restricted to the use of the following methods:
  - 1. Where the extra work involved is covered by unit prices quoted in the proposal, or subsequently agreed to by the Contractor, Designer, Owner and State Construction Office the value of the change shall be computed by application of unit prices based on quantities, estimated or actual as agreed of the items involved, except in such cases where a quantity exceeds the estimated quantity allowance in the contract by one hundred percent (100%) or more. In such cases, either party may elect to proceed under subparagraph c2 herein. If neither party elects to proceed under c2, then unit prices shall apply.
  - 2. The contracting parties shall negotiate and agree upon the equitable value of the change prior to issuance of the change order, and the change order shall stipulate the corresponding lump sum adjustment to the contract price.

- d. Under Paragraph "b" and Methods "c(2)" above, the allowances for overhead and profit combined shall be as follows: all contractors (the single contracting entity (prime), his subcontractors (1<sup>st</sup> tier subs), or their sub-subcontractors (2<sup>nd</sup> tier subs, 3<sup>rd</sup> tier subs, etc)) shall be allowed a maximum of 10% on work they each self-perform; the prime contractor shall be allowed a maximum of 5% on contracted work of his 1<sup>st</sup> tier sub; 1<sup>st</sup> tier, 2<sup>nd</sup> tier, 3<sup>rd</sup> tier, etc contractors shall be allowed a maximum of 2.5% on the contracted work of their subs. ; Under Method "c(1)", no additional allowances shall be made for overhead and profit. In the case of deductible change orders, under Method "c(2)" and Paragraph (b) above, the contractor shall include no less than five percent (5%) profit, but no allowances for overhead.
- e. The term "net cost" as used herein shall mean the difference between all proper cost additions and deductions. The "cost" as used herein shall be limited to the following:
1. The actual costs of materials and supplies incorporated or consumed as part of the work;
  2. The actual costs of labor expended on the project site; labor expended in coordination, change order negotiation, record document maintenance, shop drawing revision or other tasks necessary to the administration of the project are considered overhead whether they take place in an office or on the project site.
  3. The actual costs of labor burden, limited to the costs of social security (FICA) and Medicare/Medicaid taxes; unemployment insurance costs; health/dental/vision insurance premiums; paid employee leave for holidays, vacation, sick leave, and/or petty leave, not to exceed a total of 30 days per year; retirement contributions; worker's compensation insurance premiums; and the costs of general liability insurance when premiums are computed based on payroll amounts; the total of which shall not exceed thirty percent (30%) of the actual costs of labor;
  4. The actual costs of rental for tools, excluding hand tools; equipment; machinery; and temporary facilities required for the work;
  5. The actual costs of premiums for bonds, insurance, permit fees, and sales or use taxes related to the work.
- Overtime and extra pay for holidays and weekends may be a cost item only to the extent approved by the owner.
- f. Should concealed conditions be encountered in the performance of the work below grade, or should concealed or unknown conditions in an existing structure be at variance with the conditions indicated by the contract documents, the contract sum and time for completion may be equitably adjusted by change order upon claim by either party made within thirty (30) days after the condition has been identified. The cost of such change shall be arrived at by one of the foregoing methods. All change orders shall be supported by a unit cost breakdown showing method of arriving at net cost as defined above.
- g. In all change orders, the procedure will be for the designer to request proposals for the change order work in writing. The contractor will provide such proposal and supporting data in suitable format. The designer shall verify correctness. Delay in the processing of the change order due to lack of proper submittal by the contractor of all required supporting data shall not constitute grounds for a time extension or basis of a claim. Within fourteen (14) days after receipt of the contractor's accepted proposal including all supporting documentation required by the designer, the designer shall prepare the change order and forward to the contractor for his signature or otherwise respond, in writing, to

the contractor's proposal. Within seven (7) days after receipt of the change order executed by the contractor, the designer shall, certify the change order by his signature, and forward the change order and all supporting data to the owner for the owner's signature. The owner shall execute the change order and forward to the State Construction Office for final approval, within seven (7) days of receipt. The State Construction Office shall act on the change order within seven (7) days. In case of emergency or extenuating circumstances, approval of changes may be obtained verbally by telephone or field orders approved by all parties, then shall be substantiated in writing as outlined under normal procedure.

- h. At the time of signing a change order, the contractor shall be required to certify as follows:

"I certify that my bonding company will be notified forthwith that my contract has been changed by the amount of this change order, and that a copy of the approved change order will be mailed upon receipt by me to my surety."

- i. A change order, when issued, shall be full compensation, or credit, for the work included, omitted or substituted. It shall show on its face the adjustment in time for completion of the project as a result of the change in the work.
- j. If, during the progress of the work, the owner requests a change order and the contractor's terms are unacceptable, the owner, with the approval of the State Construction Office, may require the contractor to perform such work on a time and material basis whereupon the contractor shall proceed and keep accurately on such form as specified by the Designer or owner, a correct account of cost together with all proper invoices, payrolls and supporting data. Upon completion of the work a change order will be prepared with allowances for overhead and profit per paragraph d. above and "net cost" and "cost" per paragraph e. above. Without prejudice, nothing in this paragraph shall preclude the owner from performing or to have performed that portion of the work requested in the change order.

## **ARTICLE 20 - CLAIMS FOR EXTRA COST**

- a. Should the contractor consider that as a result of instructions given by the designer, he is entitled to extra cost above that stated in the contract, he shall give written notice thereof to the designer within seven (7) days without delay. The written notice shall clearly state that a claim for extra cost is being made and shall provide a detailed justification for the extra cost. The contractor shall not proceed with the work affected until further advised, except in emergency involving the safety of life or property, which condition is covered in Article 19(b) and Article 11(h). No claims for extra compensation shall be considered unless the claim is so made. The designer shall render a written decision within seven (7) days of receipt of claim.
- b. The contractor shall not act on instructions received by him from persons other than the designer, and any claims for extra compensation or extension of time on account of such instruction will not be honored. The designer shall not be responsible for misunderstandings claimed by the contractor of verbal instructions which have not been confirmed in writing, and in no case shall instructions be interpreted as permitting a departure from the contract documents unless such instruction is confirmed in writing and supported by a properly authorized change order.
- c. Should a claim for extra compensation that complies with the requirements of (a) above by the contractor and is denied by the designer or owner, and cannot be resolved by a

representative of the State Construction Office, the contractor may request a mediation in connection with GS 143-128(f1) in the dispute resolution rules adopted by the State Building Commission (1 N.C.A.C. 30H .0101 through .1001). If the contractor is unable to resolve its claim as a result of mediation, the contractor may pursue the claim in accordance with the provisions of G.S. 143-135.3, or G.S. 143-135.6 where Community Colleges are the owner, and the following:

1. A contractor who has not completed a contract with a board for construction or repair work and who has not received the amount he claims is due under the contract may submit a verified written claim to the director of the State Construction Office of the Department of Administration for the amount the contractor claims is due. The director may deny, allow or compromise the claim, in whole or in part. A claim under this subsection is not a contested case under Chapter 150B of the General Statutes.
2.
  - (a) A contractor who has completed a contract with a board for construction or repair work and who has not received the amount he claims is due under the contract may submit a verified written claim to the director of the State Construction Office of the Department of Administration for the amount the contractor claims is due. The claim shall be submitted within sixty (60) days after the contractor receives a final statement of the board's disposition of his claim and shall state the factual basis for the claim.
  - (b) The director shall investigate a submitted claim within ninety (90) days of receiving the claim, or within any longer time period upon which the director and the contractor agree. The contractor may appear before the director, either in person or through counsel, to present facts and arguments in support of his claim. The director may allow, deny or compromise the claim, in whole or in part. The director shall give the contractor a written statement of the director's decision on the contractor's claim.
  - (c) A contractor who is dissatisfied with the director's decision on a claim submitted under this subsection may commence a contested case on the claim under Chapter 150B of the General Statutes. The contested case shall be commenced within sixty (60) days of receiving the director's written statement of the decision.
  - (d) As to any portion of a claim that is denied by the director, the contractor may, in lieu of the procedures set forth in the preceding subsection of this section, within six (6) months of receipt of the director's final decision, institute a civil action for the sum he claims to be entitled to under the contract by filing a verified complaint and the issuance of a summons in the Superior Court of Wake County or in the superior court of any county where the work under the contract was performed. The procedure shall be the same as in all civil actions except that all issues shall be tried by the judge, without a jury.

## **ARTICLE 21 - MINOR CHANGES IN THE WORK**

The designer will have the authority to order minor changes in the work not involving an adjustment in the contract sum or time for completion, and not inconsistent with the intent of the contract documents. Such changes shall be effected by written order, copied to the State Construction Office, and shall be binding on the owner and the contractor.

## **ARTICLE 22 - UNCORRECTED FAULTY WORK**

Should the correction of faulty or damaged work be considered inadvisable or inexpedient by the owner and the designer, the owner shall be reimbursed by the contractor. A change order will be issued to reflect a reduction in the contract sum.

## **ARTICLE 23 - TIME OF COMPLETION, DELAYS, EXTENSION OF TIME**

- a. The time of completion is stated in the Supplementary General Conditions and in the Form of Construction Contract. The Project Expediter, upon notice of award of contract, shall prepare a construction schedule to complete the project within the time of completion as required by Article 14.
- b. The contractors shall commence work to be performed under this agreement on a date to be specified in a written Notice to Proceed from the designer and shall fully complete all work hereunder within the time of completion stated. Time is of the essence and the contractor acknowledges the Owner will likely suffer financial damage for failure to complete the work within the time of completion. For each day in excess of the above number of days, the contractor(s) shall pay the owner the sum stated as liquidated damages reasonably estimated in advance to cover the losses to be incurred by the owner by reason of failure of said contractor(s) to complete the work within the time specified, such time being in the essence of this contract and a material consideration thereof. Should the work be delayed by both the owner and contractor, liquidated damages shall be apportioned to reflect the delays of each party. In the case of concurrent delays, contractor caused delays shall be accounted for before owner and designer caused delays.
- c. In the event of multiple prime contractors, the designer shall be the judge as to the division of responsibility between the contractor(s), based on the construction schedule, weekly reports and job records, and shall apportion the amount of liquidated damages to be paid by each of them, according to delay caused by any or all of them.
- d. If the contractor is delayed at any time in the progress of his work solely by any act or negligence of the owner, the designer, or by any employee of either; by any separate contractor employed by the owner; by changes ordered in the work; by labor disputes at the project site; by abnormal weather conditions not reasonably anticipated for the locality where the work is performed; by unavoidable casualties; by any causes beyond the contractor's control; or by any other causes which the designer and owner determine may justify the delay, then the contract time may be extended by change order only for the time which the designer and owner may determine is reasonable.

Time extensions will not be granted for rain, wind, snow or other natural phenomena of normal intensity for the locality where work is performed. For purpose of determining extent of delay attributable to unusual weather phenomena, a determination shall be made by comparing the weather for the contract period involved with the average of the preceding five (5) year climatic range during the same time interval based on the National Oceanic and Atmospheric Administration National Weather Service statistics for the locality where work is performed and on daily weather logs kept on the job site by the contractor reflecting the effect of the weather on progress of the work and initialed by the designer's representative. No weather delays shall be considered after the building is dried in unless work claimed to be delayed is on the critical path of the baseline schedule or approved updated schedule. Time extensions for weather delays, acts of God, labor disputes, fire, delays in transportation, unavoidable casualties or other delays which are beyond the control of the Owner do not entitle the Contractor to compensable damages for delays. Any contractor claim for compensable damages for delays is limited to delays caused solely by the owner or its agents. Contractor caused delays shall be accounted for before owner or designer caused delays in the case of concurrent delays.

- e. Request for extension of time shall be made in writing to the designer, copies to the owner and SCO, within twenty (20) days following cause of delay. In case of continuing cause for delay, the Contractor shall notify the Designer to the designer, copies to the owner and SCO, of the delay within 20 days of the beginning of the delay and only one claim is necessary.
- f. The contractor shall notify his surety in writing of extension of time granted.
- g. No claim for time extension shall be allowed on account of failure of the designer to furnish drawings or instructions until twenty (20) days after demand for such drawings and/or instructions. See Article 5c. Demand must be in written form clearly stating the potential for delay unless the drawings or instructions are provided. Any delay granted will begin after the twenty (20) day demand period is concluded.

#### **ARTICLE 24 - PARTIAL UTILIZATION/BENEFICIAL OCCUPANCY**

- a. The owner may desire to occupy or utilize all or a portion of the project prior to the completion of the project.
- b. Should the owner request a utilization of a building or portion thereof, the designer shall perform a designer final inspection of area after being notified by the contractor that the area is ready for such. After the contractor has completed designer final inspection punch list and the designer has verified, then the designer shall schedule a beneficial occupancy inspection at a time and date acceptable to the owner, contractor(s) and State Construction Office. If beneficial occupancy is granted by the State Construction Office, in such areas the following will be established:
  - 1. The beginning of guarantees and warranties period for the equipment necessary to support. in the area.
  - 2. The owner assumes all responsibilities for utility costs for entire building.
  - 2. Contractor will obtain consent of surety.
  - 3. Contractor will obtain endorsement from insurance company permitting beneficial occupancy.
- c. The owner shall have the right to exclude the contractor from any part of the project which the designer has so certified to be substantially complete, but the owner will allow the contractor reasonable access to complete or correct work to bring it into compliance with the contract.
- d. Occupancy by the owner under this article will in no way relieve the contractor from his contractual requirement to complete the project within the specified time. The contractor will not be relieved of liquidated damages because of beneficial occupancy. The designer may prorate liquidated damages based on the percentage of project occupied.

#### **ARTICLE 25 - FINAL INSPECTION, ACCEPTANCE, AND PROJECT CLOSEOUT**

- a. Upon notification from the contractor(s) that the project is complete and ready for inspection, the designer shall make a Designer final inspection to verify that the project is complete and ready for SCO final inspection. Prior to SCO final inspection, the contractor(s) shall complete all items requiring corrective measures noted at the Designer

final inspection. The designer shall schedule a SCO final inspection at a time and date acceptable to the owner, contractor(s) and State Construction Office.

- b. At the SCO final inspection, the designer and his consultants shall, if job conditions warrant, record a list of items that are found to be incomplete or not in accordance with the contract documents. At the conclusion of the SCO final inspection, the designer and State Construction Office representative shall make one of the following determinations:
  - 1. That the project is completed and accepted.
  - 2. That the project will be accepted subject to the correction of the list of discrepancies (punch list). All punch list items must be completed within thirty (30) days of SCO final inspection or the owner may invoke Article 28, Owner's Right to Do Work.
  - 4. That the project is not complete and another date for a SCO final inspection will be established.
- c. Within fourteen (14) days of final acceptance per Paragraph b1 or within fourteen (14) days after completion of punch list per Paragraph b2 above, the designer shall certify the work and issue applicable certificate(s) of compliance.
- d. Any discrepancies listed or discovered after the date of SCO final inspection and acceptance under Paragraphs b1 or b2 above shall be handled in accordance with Article 42, Guarantee.
- f. The final acceptance date will establish the following:
  - 1. The beginning of guarantees and warranties period.
  - 2. The date on which the contractor's insurance coverage for public liability, property damage and builder's risk may be terminated.
  - 3. That no liquidated damages (if applicable) shall be assessed after this date.
  - 4. The termination date of utility cost to the contractor.
- g. **Prior to issuance of final acceptance date, the contractor shall have his authorized representatives visit the project and give full instructions to the designated personnel regarding operating, maintenance, care, and adjustment of allequipment and special construction elements. In addition, the contractor shall provide to the owner a complete instructional video (media format acceptable to the owner) on the operation, maintenance, care and adjustment of all equipment and special construction elements.**

## **ARTICLE 26 - CORRECTION OF WORK BEFORE FINAL PAYMENT**

- a. Any work, materials, fabricated items or other parts of the work which have been condemned or declared not in accordance with the contract by the designer shall be promptly removed from the work site by the contractor, and shall be immediately replaced by new work in accordance with the contract at no additional cost to the owner. Work or property of other contractors or the owner, damaged or destroyed by virtue of such faulty work, shall be made good at the expense of the contractor whose work is faulty.



- b. Correction of condemned work described above shall commence within twenty-four (24) hours after receipt of notice from the designer, and shall make satisfactory progress, as determined by the designer, until completed.
- c. Should the contractor fail to proceed with the required corrections, then the owner may complete the work in accordance with the provisions of Article 28.

#### **ARTICLE 27 - CORRECTION OF WORK AFTER FINAL PAYMENT**

See Article 35, Performance Bond and Payment Bond, and Article 42, Guarantee. Neither the final certificate, final payment, occupancy of the premises by the owner, nor any provision of the contract, nor any other act or instrument of the owner, nor the designer, shall relieve the contractor from responsibility for negligence, or faulty material or workmanship, or failure to comply with the drawings and specifications. Contractor shall correct or make good any defects due thereto and repair any damage resulting there from, which may appear during the guarantee period following final acceptance of the work except as stated otherwise under Article 42, Guarantee. The owner will report any defects as they may appear to the contractor and establish a time limit for completion of corrections by the contractor. The owner will be the judge as to the responsibility for correction of defects.

#### **ARTICLE 28 - OWNER'S RIGHT TO DO WORK**

If, during the progress of the work or during the period of guarantee, the contractor fails to prosecute the work properly or to perform any provision of the contract, the owner, after seven (7) days' written notice sent by certified mail, return receipt requested, to the contractor from the designer, may perform or have performed that portion of the work. The cost of the work may be deducted from any amounts due or to become due to the contractor, such action and cost of same having been first approved by the designer. Should the cost of such action of the owner exceed the amount due or to become due the contractor, then the contractor or his surety, or both, shall be liable for and shall pay to the owner the amount of said excess.

#### **ARTICLE 29 - ANNULMENT OF CONTRACT**

If the contractor fails to begin the work under the contract within the time specified, or the progress of the work is not maintained on schedule, or the work is not completed within the time above specified, or fails to perform the work with sufficient workmen and equipment or with sufficient materials to ensure the prompt completion of said work, or shall perform the work unsuitably or shall discontinue the prosecution of the work, or if the contractor shall become insolvent or be declared bankrupt or commit any act of bankruptcy or insolvency, or allow any final judgment to stand against him unsatisfied for a period of forty-eight (48) hours, or shall make an assignment for the benefit of creditors, or for any other cause whatsoever shall not carry on the work in an acceptable manner, the owner may give notice in writing, sent by certified mail, return receipt requested, to the contractor and his surety of such delay, neglect or default, specifying the same, and if the contractor within a period of seven (7) days after such notice shall not proceed in accordance therewith, then the owner shall, declare this contract in default, and, thereupon, the surety shall promptly take over the work and complete the performance of this contract in the manner and within the time frame specified. In the event the surety shall fail to take over the work to be done under this contract within seven (7) days after being so notified and notify the owner in writing, sent by certified mail, return receipt requested, that he is taking the same over and stating that he will diligently pursue and complete the same, the owner shall have full power and authority, without violating the contract, to take the prosecution of the work out of the hands of said contractor, to appropriate or use any or all contract materials and equipment on the grounds as may be suitable and acceptable and may enter into an agreement, either by public letting or negotiation, for the completion of said contract according to the terms and provisions thereof

or use such other methods as in his opinion shall be required for the completion of said contract in an acceptable manner. All costs and charges incurred by the owner, together with the costs of completing the work under contract, shall be deducted from any monies due or which may become due said contractor and surety. In case the expense so incurred by the owner shall be less than the sum which would have been payable under the contract, if it had been completed by said contractor, then the said contractor and surety shall be entitled to receive the difference, but in case such expense shall exceed the sum which would have been payable under the contract, then the contractor and the surety shall be liable and shall pay to the owner the amount of said excess.

#### **ARTICLE 30 - CONTRACTOR'S RIGHT TO STOP WORK OR TERMINATE THE CONTRACT**

- a. Should the work be stopped by order of a court having jurisdiction, or by order of any other public authority for a period of three months, due to cause beyond the fault or control of the contractor, or if the owner should fail or refuse to make payment on account of a certificate issued by the designer within forty-five (45) days after receipt of same, then the contractor, after fifteen (15) days' written notice sent by certified mail, return receipt requested, to the owner and the designer, may suspend operations on the work or terminate the contract.
- b. The owner shall be liable to the contractor for the cost of all materials delivered and work performed on this contract plus 10 percent overhead and profit and shall make such payment. The designer shall be the judge as to the correctness of such payment.

#### **ARTICLE 31 - REQUEST FOR PAYMENT**

- a. Not later than the fifth day of the month, the contractor shall submit to the designer a request for payment for work done during the previous month. The request shall be in the form agreed upon between the contractor and the designer, but shall show substantially the value of work done and materials delivered to the site during the period since the last payment, and shall sum up the financial status of the contract with the following information:
  1. Total of contract including change orders.
  2. Value of work completed to date.
  3. Less five percent (5%) retainage, provided however, that after fifty percent (50%) of the contractor's work has been satisfactorily completed on schedule, with approval of the owner and the State Construction Office and written consent of the surety, further requirements for retainage will be waived only so long as work continues to be completed satisfactorily and on schedule.
  4. Less previous payments.
  5. Current amount due.
- b. The contractor, upon request of the designer, shall substantiate the request with invoices of vouchers or payrolls or other evidence.
- c. Prior to submitting the first request, the contractor shall prepare for the designer a schedule showing a breakdown of the contract price into values of the various parts of the work, so arranged as to facilitate payments to subcontractors in accordance with Article 17, Contractor and Subcontractor Relationships. The contractor(s) shall list the

value of each subcontractor and supplier, identifying each minority business subcontractor and supplier as listed in Affidavit C, if applicable.

- d. When payment is made on account of stored materials and equipment, such materials must be stored on the owner's property, and the requests for payments shall be accompanied by invoices or bills of sale or other evidence to establish the owner's title to such materials and equipment. Such payments will be made only for materials that have been customized or fabricated specifically for this project. Raw materials or commodity products including but not limited to piping, conduit, CMU, metal studs and gypsum board may not be submitted. Responsibility for such stored materials and equipment shall remain with the contractor regardless of ownership title. Such stored materials and equipment shall not be removed from the owner's property. Should the space for storage on-site be limited, the contractor, at his option, shall be permitted to store such materials and/or equipment in a suitable space off-site. Should the contractor desire to include any such materials or equipment in his application for payment, they must be stored in the name of the owner in an independent, licensed, bonded warehouse approved by the designer, owner and the State Construction Office and located as close to the site as possible. The warehouse selected must be approved by the contractor's bonding and insurance companies; the material to be paid for shall be assigned to the owner and shall be inspected by the designer. Upon approval by the designer, owner and SCO of the storage facilities and materials and equipment, payment therefore will be certified. Responsibility for such stored materials and equipment shall remain with the contractor. Such stored materials and equipment shall not be moved except for transportation to the project site. Under certain conditions, the designer may approve storage of materials at the point of manufacture, which conditions shall be approved by the designer, the owner and the State Construction Office prior to approval for the storage and shall include an agreement by the storing party which unconditionally gives the State absolute right to possession of the materials at anytime. Bond, security and insurance protection shall continue to be the responsibility of the contractor(s).
- e. In the event of beneficial occupancy, retainage of funds due the contractor(s) may be reduced with the approval of the State Construction Office to an equitable amount to cover the list of items to be completed or corrected. Retainage may not be reduced to less than two and one-half (2 1/2) times the estimated value of the work to be completed or corrected. Reduction of retainage must be with the consent and approval of the contractor's bonding company.

## **ARTICLE 32 - CERTIFICATES OF PAYMENT AND FINAL PAYMENT**

- a. Within five (5) days from receipt of request for payment from the contractor, the designer shall issue and forward to the owner a certificate for payment. This certificate shall indicate the amount requested or as approved by the designer. If the certificate is not approved by the designer, he shall state in writing to the contractor and the owner his reasons for withholding payment.
- b. No certificate issued or payment made shall constitute an acceptance of the work or any part thereof. The making and acceptance of final payment shall constitute a waiver of all claims by the owner except:
  - 1. Claims arising from unsettled liens or claims against the contractor.
  - 2. Faulty work or materials appearing after final payment.
  - 3. Failure of the contractor to perform the work in accordance with drawings and specifications, such failure appearing after payment.

4. As conditioned in the performance bond and payment bond.
- c. The making and acceptance of final payment shall constitute a waiver of all claims by the contractor except those claims previously made and remaining unsettled (Article 20(c)).
- d. Prior to submitting request for final payment to the designer for approval, the contractor shall fully comply with all requirements specified in the “project closeout” section of the specifications. These requirements include but not limited to the following:
  1. Submittal of Product and Operating Manuals, Warranties and Bonds, Guarantees, Maintenance Agreements, As-Built Drawings, Certificates of Inspection or Approval from agencies having jurisdiction. (The designer must approve the Manuals prior to delivery to the owner).
  2. Transfer of Required attic stock material and all keys in an organized manner.
  3. Record of Owner’s training.
  4. Resolution of any final inspection discrepancies.
  5. Granting access to Contractor’s records, if Owner’s internal auditors have made a request for such access pursuant to Article 52.
- e. The contractor shall forward to the designer, the final application for payment along with the following documents:
  1. List of minority business subcontractors and material suppliers showing breakdown of contract amounts and total actual payments to subs and material suppliers.
  2. Affidavit of Release of Liens.
  3. Affidavit of contractors of payment to material suppliers and subcontractors. (See Article 36).
  4. Consent of Surety to Final Payment.
  5. Certificates of state agencies required by state law.
- f. The designer will not authorize final payment until the work under contract has been certified by designer, certificates of compliance issued, and the contractor has complied with the closeout requirements. The designer shall forward the contractor’s final application for payment to the owner along with respective certificate(s) of compliance required by law.

### **ARTICLE 33 - PAYMENTS WITHHELD**

- a. The designer with the approval of the State Construction Office may withhold payment for the following reasons:
  1. Faulty work not corrected.

2. The unpaid balance on the contract is insufficient to complete the work in the judgment of the designer.
  3. To provide for sufficient contract balance to cover liquidated damages that will be assessed.
- b. The secretary of the Department of Administration may authorize the withholding of payment for the following reasons:
    1. Claims filed against the contractor or evidence that a claim will be filed.
    2. Evidence that subcontractors have not been paid.
  - c. The Owner may withhold all or a portion of Contractor's general conditions costs set forth in the approved schedule of values, if Contractor has failed to comply with: (1) a request to access its records by Owner's internal auditors pursuant to Article 52; (2) a request for a plan of action and/or recovery schedule under Article 14.j or provide The Owner; (3) a request to provide an electronic copies of Contractor's baseline schedule, updates with all logic used to create the schedules in the original format of the scheduling software; and (4) Contractor's failure to have its Superintendent on the Project full-time; (
  - d. When grounds for withholding payments have been removed, payment will be released. Delay of payment due the contractor without cause will make owner liable for payment of interest to the contractor in accordance with G.S. 143-134.1. As provided in G.S.143-134.1(e) the owner shall not be liable for interest on payments withheld by the owner for unsatisfactory job progress, defective construction not remedied, disputed work, or third-party claims filed against the owner or reasonable evidence that a third-party claim will be filed.

## **ARTICLE 34 - MINIMUM INSURANCE REQUIREMENTS**

The work under this contract shall not commence until the contractor has obtained all required insurance and verifying certificates of insurance have been approved in writing by the owner. These certificates shall document that coverages afforded under the policies will not be cancelled, reduced in amount or coverages eliminated until at least thirty (30) days after mailing written notice, by certified mail, return receipt requested, to the insured and the owner of such alteration or cancellation. If endorsements are needed to comply with the notification or other requirements of this article copies of the endorsements shall be submitted with the certificates.

### **a. Worker's Compensation and Employer's Liability**

The contractor shall provide and maintain, until final acceptance, workmen's compensation insurance, as required by law, as well as employer's liability coverage with minimum limits of \$100,000.

### **b. Public Liability and Property Damage**

The contractor shall provide and maintain, until final acceptance, comprehensive general liability insurance, including coverage for premises operations, independent contractors, completed operations, products and contractual exposures, as shall protect such contractors from claims arising out of any bodily injury, including accidental death, as well as from claims for property damages which may arise from operations under this contract, whether such operations be by the contractor or by any subcontractor, or by

anyone directly or indirectly employed by either of them and the minimum limits of such insurance shall be as follows:

Bodily Injury:	\$500,000 per occurrence
Property Damage:	\$100,000 per occurrence / \$300,000 aggregate

In lieu of limits listed above, a \$500,000 combined single limit shall satisfy both conditions.

Such coverage for completed operations must be maintained for at least two (2) years following final acceptance of the work performed under the contract.

**c. Property Insurance (Builder's Risk/Installation Floater)**

The contractor shall purchase and maintain property insurance until final acceptance, upon the entire work at the site to the full insurable value thereof. This insurance shall include the interests of the owner, the contractor, the subcontractors and sub-subcontractors in the work and shall insure against the perils of fire, wind, rain, flood, extended coverage, and vandalism and malicious mischief. If the owner is damaged by failure of the contractor to purchase or maintain such insurance, then the contractor shall bear all reasonable costs properly attributable thereto; the contractor shall effect and maintain similar property insurance on portions of the work stored off the site when request for payment per articles so includes such portions.

**d. Deductible**

Any deductible, if applicable to loss covered by insurance provided, is to be borne by the contractor.

**e. Other Insurance**

The contractor shall obtain such additional insurance as may be required by the owner or by the General Statutes of North Carolina including motor vehicle insurance, in amounts not less than the statutory limits.

**f. Proof of Carriage**

The contractor shall furnish the owner with satisfactory proof of carriage of the insurance required before written approval is granted by the owner.

**ARTICLE 35 - PERFORMANCE BOND AND PAYMENT BOND**

- a. Each contractor shall furnish a performance bond and payment bond executed by a surety company authorized to do business in North Carolina. The bonds shall be in the full contract amount. Bonds shall be executed in the form bound with these specifications.
- b. All bonds shall be countersigned by an authorized agent of the bonding company who is licensed to do business in North Carolina.

**ARTICLE 36 - CONTRACTOR'S AFFIDAVIT**

The final payment of retained amount due the contractor on account of the contract shall not become due until the contractor has furnished to the owner through the designer an affidavit signed, sworn and notarized to the effect that all payments for materials, services or subcontracted work in connection with his contract have been satisfied, and that no claims or

liens exist against the contractor in connection with this contract. In the event that the contractor cannot obtain similar affidavits from subcontractors to protect the contractor and the owner from possible liens or claims against the subcontractor, the contractor shall state in his affidavit that no claims or liens exist against any subcontractor to the best of his (the contractor's) knowledge, and if any appear afterward, the contractor shall save the owner harmless.

#### **ARTICLE 37 - ASSIGNMENTS**

The contractor shall not assign any portion of this contract nor subcontract in its entirety. Except as may be required under terms of the performance bond or payment bond, no funds or sums of money due or become due the contractor under the contract may be assigned.

#### **ARTICLE 38 - USE OF PREMISES**

- a. The contractor(s) shall confine his apparatus, the storage of materials and the operations of his workmen to limits indicated by law, ordinances, permits or directions of the designer and owner and shall not exceed those established limits in his operations.
- b. The contractor(s) shall not load or permit any part of the structure to be loaded with a weight that will endanger its safety.
- c. The contractor(s) shall enforce the designer's and owner's instructions regarding signs, advertisements, fires and smoking.
- d. No firearms, any type of alcoholic beverages, or drugs (other than those prescribed by a physician) will be permitted at the job site.

#### **ARTICLE 39 - CUTTING, PATCHING AND DIGGING**

- a. The contractor shall do all cutting, fitting or patching of his work that may be required to make its several parts come together properly and fit it to receive or be received by work of other contractors shown upon or reasonably implied by the drawings and specifications for the completed structure, as the designer may direct.
- b. Any cost brought about by defective or ill-timed work shall be borne by the party responsible therefor.
- c. No contractor shall endanger any work of another contractor by cutting, digging or other means. No contractor shall cut or alter the work of any other contractor without the consent of the designer and the affected contractor(s).

#### **ARTICLE 40 - UTILITIES, STRUCTURES, SIGNS**

- a. The contractor shall provide necessary and adequate facilities for water, electricity, gas, oil, sewer and other utility services which maybe necessary and required for completion of the project including all utilities required for testing, cleaning, balancing, and sterilization of designated plumbing, mechanical and electrical systems. Any permanent meters installed shall be listed in the contractor's name until work has a final acceptance. The contractor will be solely responsible for all utility costs prior to final acceptance. Contractor shall contact all affected utility companies prior to bid to determine their requirements to provide temporary and permanent service and include all costs associated with providing those services in their bid. Coordination of the work of the utility companies during construction is the sole responsibility of the contractor.

- b. Meters shall be relisted in the owner's name on the day following final acceptance of the Project Expediter's work, and the owner shall pay for services used after that date.
- c. The owner shall be reimbursed for all metered utility charges after the meter is relisted in the owner's name and prior to completion and acceptance of the work of **all** contractors. Reimbursement shall be made by the contractor whose work has not been completed and accepted. If the work of two or more contractors has not been completed and accepted, reimbursement to the owner shall be paid by the contractors involved on the basis of assessments by the designer.
- d. Prior to the operation of permanent systems, the Project Expediter will provide temporary power, lighting, water, and heat to maintain space temperature above freezing, as required for construction operations.
- e. All contractors shall have the permanent building systems in sufficient readiness for furnishing temporary climatic control at the time a building is enclosed and secured. The HVAC systems shall maintain climatic control throughout the enclosed portion of the building sufficient to allow completion of the interior finishes of the building. A building shall be considered enclosed and secured when windows, doorways (exterior, mechanical, and electrical equipment rooms), and hardware are installed; and other openings have protection which will provide reasonable climatic control. The appropriate time to start the mechanical systems and climatic condition shall be jointly determined by the contractor(s), the designer and owner. Use of the equipment in this manner shall be subject to the approval of the Designer and owner and shall in no way affect the warranty requirements of the contractor(s).
- f. The electrical contractor shall have the building's permanent power wiring distribution system in sufficient readiness to provide power as required by the HVAC contractor for temporary climatic control.
- g. The electrical contractor shall have the building's permanent lighting system ready at the time the general contractor begins interior painting and shall provide adequate lighting in those areas where interior painting and finishing is being performed.
- h. Each prime contractor shall be responsible for his permanently fixed service facilities and systems in use during progress of the work. The following procedures shall be strictly adhered to:
  - 1. Prior to final acceptance of work by the State Construction Office, each contractor shall remove and replace any parts of the permanent building systems damaged through use during construction.
  - 2. Temporary filters as recommended by the equipment manufacturer in order to keep the equipment and ductwork clean and free of dust and debris shall be installed in each of the heating and air conditioning units and at each return grille during construction. New filters shall be installed in each unit prior to the owner's acceptance of the work.
  - 3. Extra effort shall be maintained to keep the building and the site adjacent to the building clean and under no circumstances shall air systems be operated if finishing and site work operations are creating dust in excess of what would be considered normal if the building were occupied.
  - 4. It shall be understood that any warranty on equipment presented to the owner shall extend from the day of final acceptance by the owner. The cost of warranting the



equipment during operation in the finishing stages of construction shall be borne by the contractor whose system is utilized.

5. The electrical contractor shall have all lamps in proper working condition at the time of final project acceptance.
- i. The Project Expediter shall provide, if required and where directed, a shed for toilet facilities and shall furnish and install in this shed all water closets required for a complete and adequate sanitary arrangement. These facilities will be available to other contractors on the job and shall be kept in a neat and sanitary condition at all times. Chemical toilets are acceptable.
- j. The Project Expediter shall, if required by the Supplementary General Conditions and where directed, erect a temporary field office, complete with lights, telephone, heat and air conditioning. A portion of this office shall be partitioned off, of sufficient size, for the use of a resident inspector, should the designer so direct.
- k. On multi-story construction projects, the Project Expediter shall provide temporary elevators, lifts, or other special equipment for the general use of all contractors. The cost for such elevators, lifts or other special equipment and the operation thereof shall be included in the Project Expediter's bid.
- l. The Project Expediter will erect one sign on the project if required. The sign shall be of sound construction, and shall be neatly lettered with black letters on white background. The sign shall bear the name of the project, and the names of prime contractors on the project, and the name of the designer and consultants. Directional signs may be erected on the owner's property subject to approval of the owner with respect to size, style and location of such directional signs. Such signs may bear the name of the contractor and a directional symbol. No other signs will be permitted except by permission of the owner.

#### **ARTICLE 41 - CLEANING UP**

- a. The contractors shall keep the building and surrounding area reasonably free from rubbish at all times, and shall remove debris from the site on a timely basis or when directed to do so by the designer or Project Expediter. The Project Expediter shall provide an on site refuse container(s) for the use of all contractors. Each contractor shall remove their rubbish and debris from the building on a daily basis. The Project Expediter shall broom clean the building as required to minimize dust and dirt accumulation.
- b. The Project Expediter shall provide and maintain suitable all-weather access to the building.
- c. Before final inspection and acceptance of the building, each contractor shall clean his portion of the work, including glass, hardware, fixtures, masonry, tile and marble (using no acid), clean and wax all floors as specified, and completely prepare the building for use by the owner, with no cleaning required by the owner.

#### **ARTICLE 42 - GUARANTEE**

- a. The contractor shall unconditionally guarantee materials and workmanship against patent defects arising from faulty materials, faulty workmanship or negligence for a period of twelve (12) months following the date of final acceptance of the work or beneficial occupancy and shall replace such defective materials or workmanship without cost to the owner.

- b. Where items of equipment or material carry a manufacturer's warranty for any period in excess of twelve (12) months, then the manufacturer's warranty shall apply for that particular piece of equipment or material. The contractor shall replace such defective equipment or materials, without cost to the owner, within the manufacturer's warranty period.
- c. Additionally, the owner may bring an action for latent defects caused by the negligence of the contractor which is hidden or not readily apparent to the owner at the time of beneficial occupancy or final acceptance, whichever occurred first, in accordance with applicable law.
- d. Guarantees for roof, equipment, materials, and supplies shall be stipulated in the specifications sections governing such roof, equipment, materials, or supplies.

#### **ARTICLE 43 - CODES AND STANDARDS**

Wherever reference is given to codes, standard specifications or other data published by regulating agencies including, but not limited to, national electrical codes, North Carolina state building codes, federal specifications, ASTM specifications, various institute specifications, etc., it shall be understood that such reference is to the latest edition including addenda published prior to the date of the contract documents.

#### **ARTICLE 44 - INDEMNIFICATION**

To the fullest extent permitted by law, the contractor shall indemnify and hold harmless the owner, the designer and the agents, consultants and employees of the owner and designer, from and against all claims, damages, losses and expenses, including, but not limited to, attorneys' fees, arising out of or resulting from the performance or failure of performance of the work, provided that any such claim, damage, loss or expense (1) is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the work itself) including the loss of use resulting there from, and (2) is caused in whole or in part by any negligent act or omission of the contractor, the contractor's subcontractor, or the agents of either the contractor or the contractor's subcontractor. Such obligation shall not be construed to negate, abridge or otherwise reduce any other right or obligation of indemnity which would otherwise exist as to any party or person described in this article.

#### **ARTICLE 45 - TAXES**

- a. Federal excise taxes do not apply to materials entering into state work (Internal Revenue Code, Section 3442(3)).
- b. Federal transportation taxes do not apply to materials entering into state work (Internal Revenue Code, Section 3475(b) as amended).
- c. North Carolina sales tax and use tax, as required by law, do apply to materials entering into state work and such costs shall be included in the bid proposal and contract sum.
- d. Local option sales and use taxes, as required by law, do apply to materials entering into state work as applicable and such costs shall be included in the bid proposal and contract sum.
- e. **Accounting Procedures for Refund of County Sales & Use Tax**

Amount of county sales and use tax paid per contractor's statements:

Contractors performing contracts for state agencies shall give the state agency for whose project the property was purchased a signed statement containing the information listed in G.S. 105-164.14(e).

The Department of Revenue has agreed that in lieu of obtaining copies of sales receipts from contractors, an agency may obtain a certified statement as of April 1, 1991 from the contractor setting forth the date, the type of property and the cost of the property purchased from each vendor, the county in which the vendor made the sale and the amount of local sales and use taxes paid thereon. If the property was purchased out-of-state, the county in which the property was delivered should be listed. The contractor should also be notified that the certified statement may be subject to audit.

In the event the contractors make several purchases from the same vendor, such certified statement must indicate the invoice numbers, the inclusive dates of the invoices, the total amount of the invoices, the counties, and the county sales and use taxes paid thereon.

Name of taxing county: The position of a sale is the retailer's place of business located within a taxing county where the vendor becomes contractually obligated to make the sale. Therefore, it is important that the county tax be reported for the county of sale rather than the county of use.

When property is purchased from out-of-state vendors and the county tax is charged, the county should be identified where delivery is made when reporting the county tax.

Such statement must also include the cost of any tangible personal property withdrawn from the contractor's warehouse stock and the amount of county sales or use tax paid thereon by the contractor.

Similar certified statements by his subcontractors must be obtained by the general contractor and furnished to the claimant.

Contractors are not to include any tax paid on supplies, tools and equipment which they use to perform their contracts and should include only those building materials, supplies, fixtures and equipment which actually become a part of or annexed to the building or structure.

#### **ARTICLE 46 - EQUAL OPPORTUNITY CLAUSE**

The non-discrimination clause contained in Section 202 (Federal) Executive Order 11246, as amended by Executive Order 11375, relative to equal employment opportunity for all persons without regard to race, color, religion, sex or national origin, and the implementing rules and regulations prescribed by the secretary of Labor, are incorporated herein.

#### **ARTICLE 47 - EMPLOYMENT OF INDIVIDUALS WITH DISABILITIES**

The contractor(s) agree not to discriminate against any employee or applicant for employment because of physical or mental disabilities in regard to any position for which the employee or applicant is qualified. The contractor agrees to take affirmative action to employ, advance in employment and otherwise treat qualified individuals with such disabilities without discrimination based upon their physical or mental disability in all employment practices.

#### **ARTICLE 48 - ASBESTOS-CONTAINING MATERIALS (ACM)**

The State of North Carolina has attempted to address all asbestos-containing materials that are to be disturbed in the project. However, there may be other asbestos-containing materials in the work areas that are not to be disturbed and do not create an exposure hazard.

Contractors are reminded of the requirements of instructions under Instructions to Bidders and General Conditions of the Contract, titled Examination of Conditions. Statute 130A, Article 19, amended August 3, 1989, established the Asbestos Hazard Management Program that controls asbestos abatement in North Carolina. The latest edition of *Guideline Criteria for Asbestos Abatement* from the State Construction Office is to be incorporated in all asbestos abatement projects for the Capital Improvement Program.

#### **ARTICLE 49 - MINORITY BUSINESS PARTICIPATION**

GS 143-128.2 establishes a ten percent (10%) goal for participation by minority businesses in total value of work for each State building project. The document, *Guidelines for Recruitment and Selection of Minority Businesses for Participation in State Construction Contracts* including Affidavits and Appendix E are hereby incorporated into and made a part of this contract.

#### **ARTICLE 50 – CONTRACTOR EVALUATION**

The contractor's overall work performance on the project shall be fairly evaluated in accordance with the State Building Commission policy and procedures, for determining qualifications to bid on future State capital improvement projects. In addition to final evaluation, interim evaluation may be prepared during the progress of project. The document, Contractor Evaluation Procedures, is hereby incorporated and made a part of this contract. The owner may request the contractor's comments to evaluate the designer.

#### **ARTICLE 51 – GIFTS**

Pursuant to N.C. Gen. Stat. § 133-32, it is unlawful for any vendor or contractor ( i.e. architect, bidder, contractor, construction manager, design professional, engineer, subcontractor, supplier, vendor, etc.), to make gifts or to give favors to any State employee. This prohibition covers those vendors and contractors who: (1) have a contract with a governmental agency; or (2) have performed under such a contract within the past year; or (3) anticipate bidding on such a contract in the future. For additional information regarding the specific requirements and exemptions, vendors and contractors are encouraged to review G.S. Sec. 133-32.

During the construction of the Project, the Contractor is prohibited from making gifts to any of the Owner's employees, Owner's project representatives (architect, engineers, construction manager and their employees), employees of the State Construction Office and/or any other State employee that may have any involvement, influence, responsibilities, oversight, management and/or duties that pertain to and/or relate to the contract administration, financial administration and/or disposition of claims arising from and/or relating to the Contract and/or Project.

#### **ARTICLE 52 – AUDITING-ACCESS TO PERSONS AND RECORDS**

In accordance with N.C. General Statute 147-64.7, the State Auditor shall have access to Contractor's officers, employees, agents and/or other persons in control of and/or responsible for the Contractor's records that relate to this Contracts for purposes of conducting audits under the referenced statute. The Owner's internal auditors shall also have the right to access and copy the Contractor's records relating to the Contract and Project during the term of the Contract and within two years following the completion of the Project/close-out of the Contract to verify accounts, accuracy, information, calculations and/or data affecting and/or

relating to Contractor's requests for payment, requests for change orders, change orders, claims for extra work, requests for time extensions and related claims for delay/extended general conditions costs, claims for lost productivity, claims for loss efficiency, claims for idle equipment or labor, claims for price/cost escalation, pass-through claims of subcontractors and/or suppliers, and/or any other type of claim for payment or damages from Owner and/or its project representatives.

## **ARTICLE 53 – NORTH CAROLINA FALSE CLAIMS ACT**

The North Carolina False Claims Act ("NCFCA"), N.C. Gen. Stat. § 1-605 through 1-618, applies to this Contract. The Contractor should familiarize itself with the entire NCFCA and should seek the assistance of an attorney if it has any questions regarding the NCFCA and its applicability to any requests, demands and/or claims for payment its submits to the State through the contracting state agency, institution, university or community college.

The purpose of the NCFCA "is to deter persons from knowingly causing or assisting in causing the State to pay claims that are false or fraudulent and to provide remedies in the form of treble damages and civil penalties when money is obtained from the State by reason of a false or fraudulent claim." (Section 1-605(b).) A contractor's liability under the NCFCA may arise from, but is not limited to: requests for payment, invoices, billing, claims for extra work, requests for change orders, requests for time extensions, claims for delay damages/extended general conditions costs, claims for lost productivity, claims for loss efficiency, claims for idle equipment or labor, claims for price/cost escalation, pass-through claims of subcontractors and/or suppliers, documentation used to support any of the foregoing requests or claims, and/or any other request for payment from the State through the contracting state agency, institution, university or community college. The parts of the NCFCA that are most likely to be enforced with respect to this type of contract are as follows:

- A "claim" is "[a]ny request or demand, whether under a contract or otherwise, for money or property and whether or not the State has title to the money or property that (i) is presented to an officer, employee, or agent of the State or (ii) is made to a contractor ... if the money or property is to be spent or used on the State's behalf or to advance a State program or interest and if the State government: (a) provides or has provided any portion of the money or property that is requested or demanded; or (b) will reimburse such contractor ... for any portion of the money or property which is requested or demanded." (Section 1-606(2).)
- "Knowing" and "knowingly." – Whenever a person, with respect to information, does any of the following: (a) Has actual knowledge of the information; (b) Acts in deliberate ignorance of the truth or falsity of the information; and/or (c) Acts in reckless disregard of the truth or falsity of the information. (Section 1-606(4).) Proof of specific intent to defraud is not required. (Section 1-606(4).)
- "Material" means having a natural tendency to influence, or be capable of influencing, the payment or receipt of money or property. (Section 1-606(4).)
- Liability. – "Any person who commits any of the following acts shall be liable to the State for three times the amount of damages that the State sustains because of the act of that person[:] ... (1) Knowingly presents or causes to be presented a false or fraudulent claim for payment or approval. (2) Knowingly makes, uses, or causes to be made or used, a false record or statement material to a false or fraudulent claim. (3) Conspires to commit a violation of subdivision (1), (2) ..." (Section 1-607(a)(1), (2).)

- The NCFCA shall be interpreted and construed so as to be consistent with the federal False Claims Act, 31 U.S.C. § 3729, et seq., and any subsequent amendments to that act. (Section 1-616(c).)

Finally, the contracting state agency, institution, university or community college may refer any suspected violation of the NCFCA by the Contractor to the Attorney General's Office for investigation. Under Section 1-608(a), the Attorney General is responsible for investigating any violation of NCFCA, and may bring a civil action against the Contractor under the NCFCA. The Attorney General's investigation and any civil action relating thereto are independent and not subject to any dispute resolution provision set forth in this Contract. (See Section 1-608(a).)

#### **ARTICLE 54 – TERMINATION FOR CONVENIENCE**

Owner may at any time and for any reason terminate Contractor's services and work at Owner's convenience. Upon receipt of such notice, Contractor shall, unless the notice directs otherwise, immediately discontinue the work and placing of orders for materials, facilities and supplies in connection with the performance of this Agreement.

Upon such termination, Contractor shall be entitled to payment only as follows: (1) the actual cost of the work completed in conformity with this Agreement; plus, (2) such other costs actually incurred by Contractor as are permitted by the prime contract and approved by Owner; (3) plus ten percent (10%) of the cost of the work referred to in subparagraph (1) above for overhead and profit. There shall be deducted from such sums as provided in this subparagraph the amount of any payments made to Contractor prior to the date of the termination of this Agreement. Contractor shall not be entitled to any claim or claim of lien against Owner for any additional compensation or damages in the event of such termination and payment.

**SECTION 00 07300**  
**SUPPLEMENTARY CONDITIONS**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. These Supplementary Conditions amend and supplement the General Conditions and other provisions of the Contract Documents as indicated below. Provisions that are not so amended or supplemented remain in full force and effect.
- B. The terms used in these Supplementary Conditions that are defined in the General Conditions have the meanings assigned to them in the General Conditions.

**1.02 MODIFICATIONS TO GENERAL CONDITIONS**

General Conditions Article 1.b:

Replace with: The owner is The Trustees of Brunswick Community College.

General Conditions Article 14.f:

This is a single prime construction contractor, therefore the contractor by default is the project expeditor. See General Conditions Article 1.i.

General Conditions Article 14.g and 14.j:

The construction contract is over \$500,000. Remove all languages pertaining to Bar Chart Schedule.

General Conditions Article 23.a:

Time from Notice to Proceed until final acceptance is 390 consecutive calendar days.

General Conditions Article 23.b:

For each consecutive calendar day in excess of the allowed completion days, the contractor shall pay the owner \$1000.00 in liquidated damages.

General Conditions Article 38.d:

Contractor shall post a sign indicating Fire Arms are prohibited from the construction site.

**END OF SECTION**

# **GUIDELINES FOR RECRUITMENT AND SELECTION OF MINORITY BUSINESSES FOR PARTICIPATION IN STATE CONSTRUCTION CONTRACTS**

In accordance with G.S. 143-128.2 (effective January 1, 2002) these guidelines establish goals for minority participation in single-prime bidding, separate-prime bidding, construction manager at risk, and alternative contracting methods, on State construction projects in the amount of \$300,000 or more. The legislation provides that the State shall have a verifiable ten percent (10%) goal for participation by minority businesses in the total value of work for each project for which a contract or contracts are awarded. These requirements are published to accomplish that end.

## **SECTION A: INTENT**

It is the intent of these guidelines that the State of North Carolina, as awarding authority for construction projects, and the contractors and subcontractors performing the construction contracts awarded shall cooperate and in good faith do all things legal, proper and reasonable to achieve the statutory goal of ten percent (10%) for participation by minority businesses in each construction project as mandated by GS 143-128.2. Nothing in these guidelines shall be construed to require contractors or awarding authorities to award contracts or subcontracts to or to make purchases of materials or equipment from minority-business contractors or minority-business subcontractors who do not submit the lowest responsible, responsive bid or bids.

## **SECTION B: DEFINITIONS**

1. Minority - a person who is a citizen or lawful permanent resident of the United States and who is:
  - a. Black, that is, a person having origins in any of the black racial groups in Africa;
  - b. Hispanic, that is, a person of Spanish or Portuguese culture with origins in Mexico, South or Central America, or the Caribbean Islands, regardless of race;
  - c. Asian American, that is, a person having origins in any of the original peoples of the Far East, Southeast Asia and Asia, the Indian subcontinent, the Pacific Islands;
  - d. American Indian, that is, a person having origins in any of the original peoples of North America; or
  - e. Female
2. Minority Business - means a business:
  - a. In which at least fifty-one percent (51%) is owned by one or more minority persons, or in the case of a corporation, in which at least fifty-one percent (51%) of the stock is owned by one or more minority persons or socially and economically disadvantaged individuals; and
  - b. Of which the management and daily business operations are controlled by one or more of the minority persons or socially and economically disadvantaged individuals who own it.
3. Socially and economically disadvantaged individual - means the same as defined in 15 U.S.C. 637. "Socially disadvantaged individuals are those who have been subjected to racial or ethnic prejudice or cultural bias because of their identity as a member of a group without regard to their individual qualities". "Economically disadvantaged individuals are those socially disadvantaged individuals whose ability to compete in the free enterprise system has been impaired due to diminished capital and credit opportunities as compared to others in the same business area who are not socially disadvantaged".
4. Public Entity - means State and all public subdivisions and local governmental units.
5. Owner - The State of North Carolina, through the Agency/Institution named in the contract.
6. Designer - Any person, firm, partnership, or corporation, which has contracted with the State of North Carolina to perform architectural or engineering, work.
7. Bidder - Any person, firm, partnership, corporation, association, or joint venture seeking to be awarded a public contract or subcontract.



8. Contract - A mutually binding legal relationship or any modification thereof obligating the seller to furnish equipment, materials or services, including construction, and obligating the buyer to pay for them.
9. Contractor - Any person, firm, partnership, corporation, association, or joint venture which has contracted with the State of North Carolina to perform construction work or repair.
10. Subcontractor - A firm under contract with the prime contractor or construction manager at risk for supplying materials or labor and materials and/or installation. The subcontractor may or may not provide materials in his subcontract.

## **SECTION C: RESPONSIBILITIES**

1. Office for Historically Underutilized Businesses, Department of Administration (hereinafter referred to as HUB Office).

The HUB Office has established a program, which allows interested persons or businesses qualifying as a minority business under G.S. 143-128.2, to obtain certification in the State of North Carolina procurement system. The information provided by the minority businesses will be used by the HUB Office to:

- a. Identify those areas of work for which there are minority businesses, as requested.
- b. Make available to interested parties a list of prospective minority business contractors and subcontractors.
- c. Assist in the determination of technical assistance needed by minority business contractors.

In addition to being responsible for the certification/verification of minority businesses that want to participate in the State construction program, the HUB Office will:

- (1) Maintain a current list of minority businesses. The list shall include the areas of work in which each minority business is interested.
- (2) Inform minority businesses on how to identify and obtain contracting and subcontracting opportunities through the State Construction Office and other public entities.
- (3) Inform minority businesses of the contracting and subcontracting process for public construction building projects.
- (4) Work with the North Carolina trade and professional organizations to improve the ability of minority businesses to compete in the State construction projects.
- (5) The HUB Office also oversees the minority business program by:
  - a. Monitoring compliance with the program requirements.
  - b. Assisting in the implementation of training and technical assistance programs.
  - c. Identifying and implementing outreach efforts to increase the utilization of minority businesses.
  - d. Reporting the results of minority business utilization to the Secretary of the Department of Administration, the Governor, and the General Assembly.

2. State Construction Office

The State Construction Office will be responsible for the following:

- a. Furnish to the HUB Office a minimum of twenty-one days prior to the bid opening the following:
  - (1) Project description and location;
  - (2) Locations where bidding documents may be reviewed;
  - (3) Name of a representative of the owner who can be contacted during the advertising period to advise who the prospective bidders are;
  - (4) Date, time and location of the bid opening.
  - (5) Date, time and location of prebid conference, if scheduled.
- b. Attending scheduled prebid conference, if necessary, to clarify requirements of the general statutes regarding minority-business participation, including the bidders' responsibilities.

- c. Reviewing the apparent low bidders' statutory compliance with the requirements listed in the proposal, that must be complied with, if the bid is to be considered as responsive, prior to award of contracts. The State reserves the right to reject any or all bids and to waive informalities.
- d. Reviewing of minority business requirements at Preconstruction conference.
- e. Monitoring of contractors' compliance with minority business requirements in the contract documents during construction.
- f. Provide statistical data and required reports to the HUB Office.
- g. Resolve any protest and disputes arising after implementation of the plan, in conjunction with the HUB Office.

### 3. Owner

Before awarding a contract, owner shall do the following:

- a. Develop and implement a minority business participation outreach plan to identify minority businesses that can perform public building projects and to implement outreach efforts to encourage minority business participation in these projects to include education, recruitment, and interaction between minority businesses and non-minority businesses.
- b. Attend the scheduled prebid conference.
- c. At least 10 days prior to the scheduled day of bid opening, notify minority businesses that have requested notices from the public entity for public construction or repair work and minority businesses that otherwise indicated to the Office for Historically Underutilized Businesses an interest in the type of work being bid or the potential contracting opportunities listed in the proposal. The notification shall include the following:
  - 1. A description of the work for which the bid is being solicited.
  - 2. The date, time, and location where bids are to be submitted.
  - 3. The name of the individual within the owner's organization who will be available to answer questions about the project.
  - 4. Where bid documents may be reviewed.
  - 5. Any special requirements that may exist.
- d. Utilize other media, as appropriate, likely to inform potential minority businesses of the bid being sought.
- e. Maintain documentation of any contacts, correspondence, or conversation with minority business firms made in an attempt to meet the goals.
- f. Review, jointly with the designer, all requirements of G.S. 143-128.2(c) and G.S. 143-128.2(f) – (i.e. bidders' proposals for identification of the minority businesses that will be utilized with corresponding total dollar value of the bid and affidavit listing good faith efforts, or affidavit of self-performance of work, if the contractor will perform work under contract by its own workforce) - prior to recommendation of award to the State Construction Office.
- g. Evaluate documentation to determine good faith effort has been achieved for minority business utilization prior to recommendation of award to State Construction Office.
- h. Review prime contractors' pay applications for compliance with minority business utilization commitments prior to payment.
- i. Make documentation showing evidence of implementation of Owner's responsibilities available for review by State Construction Office and HUB Office, upon request

### 4. Designer

Under the single-prime bidding, separate prime bidding, construction manager at risk, or alternative contracting method, the designer will:

- a. Attend the scheduled prebid conference to explain minority business requirements to the prospective bidders.
- b. Assist the owner to identify and notify prospective minority business prime and subcontractors of potential contracting opportunities.
- c. Maintain documentation of any contacts, correspondence, or conversation with minority business firms made in an attempt to meet the goals.
- d. Review jointly with the owner, all requirements of G.S. 143-128.2(c) and G.S. 143-128.2(f) – (i.e. bidders' proposals for identification of the minority businesses that will be utilized with

corresponding total dollar value of the bid and affidavit listing Good Faith Efforts, or affidavit of self-performance of work, if the contractor will perform work under contract by its own workforce) - prior to recommendation of award.

- e. During construction phase of the project, review “MBE Documentation for Contract Payment” – (Appendix E) for compliance with minority business utilization commitments. Submit Appendix E form with monthly pay applications to the owner and forward copies to the State Construction Office.
- f. Make documentation showing evidence of implementation of Designer’s responsibilities available for review by State Construction Office and HUB Office, upon request.

5. Prime Contractor(s), CM at Risk, and Its First-Tier Subcontractors

Under the single-prime bidding, the separate-prime bidding, construction manager at risk and alternative contracting methods, contractor(s) will:

- a. Attend the scheduled prebid conference.
- b. Identify or determine those work areas of a subcontract where minority businesses may have an interest in performing subcontract work.
- c. At least ten (10) days prior to the scheduled day of bid opening, notify minority businesses of potential subcontracting opportunities listed in the proposal. The notification will include the following:
  - (1) A description of the work for which the subbid is being solicited.
  - (2) The date, time and location where subbids are to be submitted.
  - (3) The name of the individual within the company who will be available to answer questions about the project.
  - (4) Where bid documents may be reviewed.
  - (5) Any special requirements that may exist, such as insurance, licenses, bonds and financial arrangements.

If there are more than three (3) minority businesses in the general locality of the project who offer similar contracting or subcontracting services in the specific trade, the contractor(s) shall notify three (3), but may contact more, if the contractor(s) so desires.

- d. During the bidding process, comply with the contractor(s) requirements listed in the proposal for minority participation.
- e. Identify on the bid, the minority businesses that will be utilized on the project with corresponding total dollar value of the bid and affidavit listing good faith efforts as required by G.S. 143-128.2(c) and G.S. 143-128.2(f).
- f. Make documentation showing evidence of implementation of PM, CM-at-Risk and First-Tier Subcontractor responsibilities available for review by State Construction Office and HUB Office, upon request.
- g. Upon being named the apparent low bidder, the Bidder shall provide one of the following: (1) an affidavit (Affidavit C) that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, which is equal to or more than the applicable goal; (2) if the percentage is not equal to the applicable goal, then documentation of all good faith efforts taken to meet the goal. Failure to comply with these requirements is grounds for rejection of the bid and award to the next lowest responsible and responsive bidder.
- h. The contractor(s) shall identify the name(s) of minority business subcontractor(s) and corresponding dollar amount of work on the schedule of values. The schedule of values shall be provided as required in Article 31 of the General Conditions of the Contract to facilitate payments to the subcontractors.
- i. The contractor(s) shall submit with each monthly pay request(s) and final payment(s), “MBE Documentation for Contract Payment” – (Appendix E), for designer’s review.
- j. During the construction of a project, at any time, if it becomes necessary to replace a minority business subcontractor, immediately advise the owner, State Construction Office, and the Director of the HUB Office in writing, of the circumstances involved. The prime contractor shall make a good faith effort to replace a minority business subcontractor with another minority business subcontractor.

- k. If during the construction of a project additional subcontracting opportunities become available, make a good faith effort to solicit subbids from minority businesses.
- l. It is the intent of these requirements apply to all contractors performing as prime contractor and first tier subcontractor under construction manager at risk on state projects.

6. **Minority Business Responsibilities**

While minority businesses are not required to become certified in order to participate in the State construction projects, it is recommended that they become certified and should take advantage of the appropriate technical assistance that is made available. In addition, minority businesses who are contacted by owners or bidders must respond promptly whether or not they wish to submit a bid.

**SECTION 4: DISPUTE PROCEDURES**

It is the policy of this state that disputes that involves a person's rights, duties or privileges, should be settled through informal procedures. To that end, minority business disputes arising under these guidelines should be resolved as governed under G.S. 143-128(g).

**SECTION 5:** These guidelines shall apply upon promulgation on state construction projects. Copies of these guidelines may be obtained from the Department of Administration, State Construction Office, (physical address) 301 North Wilmington Street, Suite 450, NC Education Building, Raleigh, North Carolina, 27601-2827, (mail address) 1307 Mail Service Center, Raleigh, North Carolina, 27699-1307, phone (919) 807-4100, Website: [www.nc-sco.com](http://www.nc-sco.com)

**SECTION 6:** In addition to these guidelines, there will be issued with each construction bid package provisions for contractual compliance providing minority business participation in the state construction program.

## MINORITY BUSINESS CONTRACT PROVISIONS (CONSTRUCTION)

### **APPLICATION:**

The **Guidelines for Recruitment and Selection of Minority Businesses for Participation in State Construction Contracts** are hereby made a part of these contract documents. These guidelines shall apply to all contractors regardless of ownership. Copies of these guidelines may be obtained from the Department of Administration, State Construction Office, (physical address) 301 North Wilmington Street, Suite 450, NC Education Building, Raleigh, North Carolina, 27601-2827, (mail address) 1307 Mail Service Center, Raleigh, North Carolina, 27699-1307, phone (919) 807-4100, Website: <http://www.nc-sco.com>

### **MINORITY BUSINESS SUBCONTRACT GOALS:**

The goals for participation by minority firms as subcontractors on this project have been set at 10%.

The bidder must identify on its bid, the minority businesses that will be utilized on the project with corresponding total dollar value of the bid and affidavit (Affidavit A) listing good faith efforts **or** affidavit (Affidavit B) of self-performance of work, if the bidder will perform work under contract by its own workforce, as required by G.S. 143-128.2(c) and G.S. 143-128.2(f).

The lowest responsible, responsive bidder must provide Affidavit C, that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, which is equal to or more than the applicable goal.

**OR**

Provide Affidavit D, that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, **with documentation of Good Faith Effort, if the percentage is not equal to the applicable goal.**

**OR**

Provide Affidavit B, which includes sufficient information for the State to determine that the bidder does not customarily subcontract work on this type project.

**The above information must be provided as required. Failure to submit these documents is grounds for rejection of the bid.**

## **MINIMUM COMPLIANCE REQUIREMENTS:**

All written statements, affidavits or intentions made by the Bidder shall become a part of the agreement between the Contractor and the State for performance of this contract. Failure to comply with any of these statements, affidavits or intentions, or with the minority business Guidelines shall constitute a breach of the contract. A finding by the State that any information submitted either prior to award of the contract or during the performance of the contract is inaccurate, false or incomplete, shall also constitute a breach of the contract. Any such breach may result in termination of the contract in accordance with the termination provisions contained in the contract. It shall be solely at the option of the State whether to terminate the contract for breach.

In determining whether a contractor has made Good Faith Efforts, the State will evaluate all efforts made by the Contractor and will determine compliance in regard to quantity, intensity, and results of these efforts. Good Faith Efforts include:

- (1) Contacting minority businesses that reasonably could have been expected to submit a quote and that were known to the contractor or available on State or local government maintained lists at least 10 days before the bid or proposal date and notifying them of the nature and scope of the work to be performed.
- (2) Making the construction plans, specifications and requirements available for review by prospective minority businesses, or providing these documents to them at least 10 days before the bid or proposals are due.
- (3) Breaking down or combining elements of work into economically feasible units to facilitate minority participation.
- (4) Working with minority trade, community, or contractor organizations identified by the Office for Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses.
- (5) Attending any prebid meetings scheduled by the public owner.
- (6) Providing assistance in getting required bonding or insurance or providing alternatives to bonding or insurance for subcontractors.
- (7) Negotiating in good faith with interested minority businesses and not rejecting them as unqualified without sound reasons based on their capabilities. Any rejection of a minority business based on lack of qualification should have the reasons documented in writing.
- (8) Providing assistance to an otherwise qualified minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required. Assisting minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help minority businesses in establishing credit.
- (9) Negotiating joint venture and partnership arrangements with minority businesses in order to increase opportunities for minority business participation on a public construction or repair project when possible.
- (10) Providing quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

## APPENDIX E

### MBE DOCUMENTATION FOR CONTRACT PAYMENTS

Prime Contractor/Architect: \_\_\_\_\_

Address & Phone: \_\_\_\_\_

Project Name: \_\_\_\_\_

Pay Application #: \_\_\_\_\_ Period: \_\_\_\_\_

The following is a list of payments made to Minority Business Enterprises on this project for the above-mentioned period.

MBE FIRM NAME	* INDICATE TYPE OF MBE	AMOUNT PAID THIS MONTH	TOTAL PAYMENTS TO DATE	TOTAL AMOUNT COMMITTED

\*Minority categories: Black, African American (B), Hispanic (H), Asian American (A), American Indian (I), Female (F), Social and Economically Disadvantage (D)

Date: \_\_\_\_\_ Approved/Certified By: \_\_\_\_\_

Name

\_\_\_\_\_

Title

\_\_\_\_\_

Signature

**SUBMIT WITH EACH PAY REQUEST & FINAL PAYMENT**



# ECS Southeast, LLC

Geotechnical Engineering Report

BCC – Public Safety Building Additional Geotech

Bolivia, Brunswick County, North Carolina

ECS Project No. 22:34536

April 25, 2024







## ECS SOUTHEAST, LLC

Geotechnical • Construction Materials • Environmental • Facilities

NC Engineering License No. F-1519

April 25, 2024

Mr. Mike Ballinger  
Brunswick Community College  
50 College Road NE  
Bolivia, North Carolina 28422

ECS Project No. 22:34536

Reference: Geotechnical Engineering Report  
**BCC – Public Safety Building Additional Geotech**  
Bolivia, Brunswick County, North Carolina

Dear Mr. Ballinger:

ECS Southeast, LLC (ECS) has finished the subsurface exploration and geotechnical engineering analyses for the above-referenced project. Our services were performed in general accordance with our agreed to scope of work. This report presents our understanding of the geotechnical aspects of the project along with the results of the field exploration and our design and construction recommendations.

It has been our pleasure to be of service to Brunswick Community College during the design phase of this project. We would appreciate the opportunity to remain involved during the continuation of the design phase, and we would like to provide our services during construction phase operations as well to verify subsurface conditions encountered in the exploration for this report. Should you have questions concerning the information contained in this report, or if we can be of further assistance to you, please contact us.

Respectfully submitted,

**ECS Southeast, LLC**

**Annemarie Crumrine, PE**  
Geotechnical Department Manager  
[ACrumrine@ecslimited.com](mailto:ACrumrine@ecslimited.com)

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4/25/2024

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"ONE FIRM. ONE MISSION."

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## 1.0 INTRODUCTION

The purpose of this study was to provide geotechnical information for the design of foundations and pavements for the proposed building located at the Brunswick Community College campus at 50 College Road NE in Bolivia, North Carolina. The recommendations developed for this report are based on project information supplied by Mr. Jack Luciano with Brunswick Community College and Mr. Doug Sherwood with Sawyer, Sherwood & Associates Architecture.

Our services were provided in accordance with our Proposal No. 22:28423, dated March 19, 2024, as authorized by Brunswick Community College on March 19, 2024.

This report contains the procedures and results of our subsurface exploration programs, review of existing site conditions, engineering analyses, and recommendations for the design and construction of the project.

The report includes the following items.

- A brief review and description of our field test procedures and the results of testing conducted;
- A review of surface topographical features and site conditions;
- A review of subsurface soil stratigraphy with pertinent available physical properties;
- Foundation recommendations;
  - Allowable bearing pressure;
  - Settlement estimates (total and differential);
- Site development recommendations;
- Reusability of soils for use as fill material;
- Pavement design recommendations;
- Discussion of groundwater impact;
- Compaction recommendations;
- Site vicinity map;
- Exploration location plan;
- Geoprobe boring logs;
- Hand auger boring logs with Kessler DCP test results; and
- CPT sounding logs.

2.0 PROJECT INFORMATION

2.1 PROJECT LOCATION/CURRENT SITE USE/PAST SITE USE

The proposed site is located at the Brunswick Community College campus at 50 College Road NE in Bolivia, North Carolina. The site is bounded on the northeast by College Road NE, on the northwest by Ocean Highway, on the southeast by more existing basins, and on the southwest by wooded area. Figure 2.1.1 below shows an image of where the site is located.



Figure 2.1.1 Site Location

At the time of our exploration, the site currently consisted of multiple existing basins. Based on our site visit, provided plans, and approximate elevations from Google Earth, the site has varying topography due to the existing basins with typical elevations on site ranging from approximately 43 to 48 feet.

2.2 PROPOSED CONSTRUCTION

The following information explains our understanding and estimations of the planned development including proposed buildings and related infrastructure.

SUBJECT	DESIGN INFORMATION / ESTIMATIONS
Usage	Education
Column Loads	Up to 100 kips
Wall Loads	Up to 3 kips per linear foot (klf)
Finish Floor Elevation	within +/- 4 feet of existing grades
Bottom of Pond Elevation	Approximately 38 feet

ECS understands the project consists of construction of a new Public Safety building with associated paved drives and parking lots. ECS understands the footprint of the proposed building was shifted northwest from the original Geotechnical Report 22:33895 but still overlaps the original proposed footprint. ECS understands the footprint of the proposed building, parking lot and drives, and proposed stormwater pond are within the footprints of existing basins. ECS understands the stormwater pond is proposed on the northern side of the site with a bottom elevation of the pond proposed to be approximately 38 feet.

3.0 FIELD EXPLORATION TESTING

Our exploration procedures are explained in greater detail in Appendix B including the Reference Notes for Cone Penetration Soundings. Our scope of work included performing five (5) CPT soundings, one (1) Geoprobe boring in the proposed stormwater pond, and two (2) hand auger borings with Kessler DCP tests in the proposed pavements. Our approximate CPT soundings, Geoprobe boring, and hand auger boring locations are shown on the Exploration Location Diagram in Appendix A.

3.1 SUBSURFACE CHARACTERIZATION

The subsurface conditions encountered were generally consistent with published geological mapping. The following sections provide generalized characterizations of the soil. Please refer to the CPT sounding and hand auger boring logs in Appendix B.

The site is located in the Coastal Plain Physiographic Province of North Carolina. The Coastal Plain is composed of seven terraces, each representing a former level of the Atlantic Ocean. Soils in this area generally consist of sedimentary materials transported from other areas by the ocean or rivers. These deposits vary in thickness from a thin veneer along the western edge of the region to more than 10,000 feet near the coast. The sedimentary deposits of the Coastal Plain rest upon consolidated rocks similar to those underlying the Piedmont and Mountain Physiographic Provinces. In general, shallow unconfined groundwater movement within the overlying soils is largely controlled by topographic gradients. Recharge occurs primarily by infiltration along higher elevations and typically discharges into streams or other surface water bodies. The elevation of the shallow water table is transient and can vary greatly with seasonal fluctuations in precipitation.

Table 3.1.1 Subsurface Stratigraphy

Approximate Depth Range	Stratum Description		Ranges of N*-Values(1) blows per foot (bpf)
0 to (0.2-0.5) (Surface cover)	N/A	Topsoil was encountered on-site with an observed thickness of approximately 2 to 6 inches. <b>Deeper topsoil or organic laden soils are likely present in wet, poorly drained areas and potentially unexplored areas of the site such as the existing basins.</b>	N/A
(0.2-0.5) to 4	I	Very Loose to Medium Dense, CLAYEY and SILTY SAND (SC, SM) and Soft to Firm, SANDY LEAN CLAY (CL) with ORGANICS.	3 to 13
4 to 13	II	Soft to Stiff, SILTY, SANDY LEAN, and LEAN CLAY (CL-ML, CL) with interbedded layers of Loose to Medium Dense, CLAYEY, SILTY and CLEAN SAND (SC, SM, SP).	3 to 29
13 to 26	III	Loose to Very Dense, SILTY TO CLEAN and CEMENTED SAND (SM, SP-SM, SP) with interbedded layers of Soft to Stiff, SILTY, SANDY LEAN, and LEAN CLAY (CL-ML, CL).	4 to 90

Notes: (1) Equivalent Corrected Standard Penetration Test Resistances

Results of the laboratory testing are shown in Appendix C.



4.0 DESIGN RECOMMENDATIONS

4.1 SHALLOW FOUNDATIONS

Provided subgrades and structural fills are prepared as recommended in this report, the anticipated column and wall loads provided in **Section 2.2** are not exceeded, and the undercutting recommendations are followed, the proposed structure can be supported by shallow foundations including column footings and continuous wall footings. We recommend the foundation design use the following parameters:

Design Parameter	Column Footing	Wall Footing
Net Allowable Bearing Pressure <sup>(1)</sup>	1,500 psf	1,500 psf
Recommended Bearing Soil Material	Stratum I Soils or Structural Fill	Stratum I Soils or Structural Fill
Minimum Width	30 inches	18 inches
Minimum Footing Embedment Depth (below slab or finished grade) <sup>(2)</sup>	12 inches	12 inches
Minimum Exterior Frost Depth (below final exterior grade)	6 inches	6 inches
Estimated Total Settlement <sup>(3)</sup>	Less than 1- inch	Less than 1- inch
Estimated Differential Settlement <sup>(4)</sup>	Less than ½ inches between columns	Less than ½ inches

- Notes:
- (1) Net allowable bearing pressure is the applied pressure in excess of the surrounding overburden soils above the base of the foundation.
  - (2) For bearing considerations and frost penetration requirements.
  - (3) Based on estimated structural loads. If final loads are different, ECS must be contacted to update foundation recommendations and settlement calculations.
  - (4) Based on maximum column/wall loads and variability in borings. Differential settlement can be re-evaluated once the foundation plans are finished.

**Potential Undercuts:** Some of the soils at the estimated foundation bearing elevation are anticipated to be adequate for support of the proposed structures. If soft or loose soils are observed at the footing bearing elevations, the soils should be undercut and removed. Undercut should be backfilled with structural fill up to the original design bottom of footing elevation; the original footing may be constructed on top of the structural fill. Due to the near surface soft clays encountered in sounding S-5a, undercutting in the vicinity of the soundings to approximately 3 to 4 feet should be anticipated prior to construction of foundations or placement of Structural Fill. In the location of the existing ponds on site, prior to placement of fill or construction, approximately 12 to 24 inches of surface material may need to be mucked out. Actual undercut depends on the amount of organic silt encountered.



## 4.2 SLABS ON GRADE

The on-site natural soils are generally considered adequate for support of the slab-on-grade floor slabs. Based on the estimation that the finished floor elevation is around 48 feet, it appears that the slabs for the structure will likely bear on the Stratum I SAND (SC, SM) or Structural Fill. The following graphic depicts our soil-supported slab recommendations:

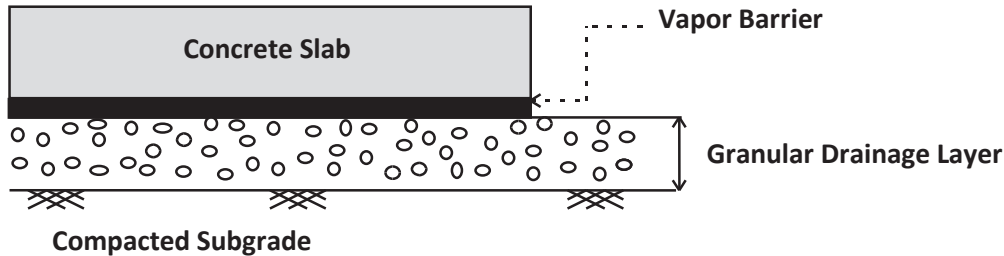


Figure 4.2.1

1. Drainage Layer Thickness: 6 inches
2. Drainage Layer Material: GRAVEL (GP) or SAND containing <5% fines passing #200 sieve (SP, SW)

Soft or yielding soils may be encountered in some areas. Those soils should be removed and replaced with compacted Structural Fill in accordance with the recommendations included in this report.

**Subgrade Modulus:** Provided the Structural Fill and Granular Drainage Layer are constructed in accordance with our recommendations, the slab may be designed estimating a modulus of subgrade reaction,  $k_1$  of 125 pci (lbs./cu. inch). The modulus of subgrade reaction value is based on a 1 ft by 1 ft plate load test basis.

**Vapor Barrier:** Before the placement of concrete, a vapor barrier may be placed on top of the granular drainage layer to provide additional protection against moisture vapor penetration through the floor slab. Curing of the slab should be performed in accordance with ACI specifications to reduce the potential for uneven drying, curling and/or cracking of the slab. Depending on proposed flooring material types, the structural engineer and/or the architect may choose to do away with the vapor barrier.

**Slab Isolation:** Soil-supported slabs should be isolated from the foundations and foundation-supported elements of the structure so that differential movement between the foundations and slab will not induce excessive shear and bending stresses in the floor slab. Where the structural configuration inhibits the use of a free-floating slab such as in a drop down footing/monolithic slab configuration, the slab should be designed to avoid overstressing of the slab.

4.3 PAVEMENTS

**Subgrade Characteristics:** Based on the results of our hand auger borings, it appears that the pavement subgrades will likely consist mainly of SAND (SC, SM) or Structural Fill.

Due to the organics encountered in hand auger borings K-1a, undercutting approximately 3 to 4 feet below existing grades should be anticipated in the vicinity of the boring prior to construction of pavements or placement of Structural Fill. In the location of the existing ponds on site, prior to placement of fill or construction, approximately 12 to 24 inches of surface material may need to be mucked out. Actual undercut depends on the amount of organic silt encountered.

California Bearing Ratio (CBR) values were estimated from the Kessler DCP tests performed on site adjacent to the hand auger borings. For preliminary design purposes, provided subgrade preparation and undercutting recommendations are followed, we recommend estimating a preliminary CBR value of 10.

We were not provided traffic loading information, so we have estimated loadings typical of this type of project. Our recommended pavement sections are based on up to 25,000 ESALs over a 20 year design life for light duty and up to 125,000 ESALs over a 20 year design life for heavy duty.

The preliminary pavement sections below are guidelines that may or may not comply with local jurisdictional minimums.

MATERIAL	PRELIMINARY PAVEMENT SECTIONS			
	FLEXIBLE PAVEMENT		RIGID PAVEMENT	
	Heavy Duty	Light Duty	Heavy Duty	Light Duty
Portland Cement Concrete (f'c = 4,500 psi)	-	-	6 in.	5 in.
Asphalt Surface Course	3 in.	2 in.	-	-
Aggregate Base Course (ABC)	8 in.	6 in.	4 in.	4 in.

In general, heavy duty sections are areas that will likely be subjected to trucks, buses, or other similar vehicles including main drive lanes of the development. Light duty sections are appropriate for vehicular traffic and parking areas.

Large, front loading trash dumpsters frequently impose concentrated front wheel loads on pavements during loading. This type of loading typically results in rutting of asphalt pavement and ultimately pavement failures. For preliminary design purposes, we recommend that the pavement in trash pickup areas consist of a 6-inch thick, 4,500 psi, reinforced concrete slab overlying 4 inches of ABC stone. When traffic loading becomes available, ECS or the Civil Engineer can design the pavements.

Prior to subbase placement and paving, CBR testing of the subgrade soils (both natural and fill soils) should be performed to evaluate the soil engineering properties for final pavement design. A minimum distance of 18 inches should be maintained between the bottom of the pavement section and the groundwater table.

**Drainage:** An important consideration with the design and construction of pavements is surface and subsurface drainage. Where standing water develops, either on the pavement surface or within the aggregate base course layer, softening of the subgrades and other problems related to the deterioration of the pavement can be expected. This is particularly important at the site due to the moisture sensitive near-surface soils. Furthermore, good drainage should help reduce the possibility of the subgrade materials becoming saturated during the normal service period of the pavement.

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## 5.0 SITE CONSTRUCTION RECOMMENDATIONS

### 5.1 SUBGRADE PREPARATION

#### 5.1.1 Stripping and Grubbing

The subgrade preparation should consist of stripping vegetation, rootmat, topsoil, existing fill, existing foundations, existing pavements, and soft or loose materials from the 10-foot expanded building and 5-foot expanded pavement limits. The soundings and borings performed in “undisturbed” areas of the site contained an observed thickness of approximately 2 to 6 inches of topsoil. Deeper topsoil or organic laden soils may be present in wet, low-lying, and poorly drained areas. In the location of the existing ponds on site, prior to placement of fill or construction, approximately 12 to 24 inches of surface material may need to be mucked out. Actual undercut depends on the amount of organic silt encountered. ECS should be retained to verify that topsoil, existing foundations and pavements, construction debris, and substandard surficial materials have been removed prior to the placement of structural fill or construction of structures.

#### 5.1.2 Proofrolling

Prior to fill placement or other construction on subgrades, the subgrades should be evaluated by an ECS field technician. The exposed subgrade should be proofrolled with construction equipment having a minimum axle load of 10 tons [e.g., tandem-axle dump truck loaded to capacity]. Proofrolling should be traversed in two perpendicular directions with overlapping passes of the vehicle under the observation of an ECS technician. This procedure is intended to assist in identifying localized yielding materials.

Where proofrolling identifies areas that are unsteady or “pumping” subgrade those areas should be repaired prior to the placement of subsequent Structural Fill or other construction materials. Methods of stabilization include undercutting and moisture conditioning. The situation should be discussed with ECS to evaluate the appropriate procedure. Test pits may be excavated to explore the shallow subsurface materials to help in evaluating the cause of the observed unsteady materials, and to assist in the evaluation of appropriate remedial actions to stabilize the subgrade.

Due to the near surface soft clays encountered in sounding S-5a, undercutting in the vicinity of the soundings to approximately 3 to 4 feet should be anticipated prior to construction of foundations or placement of Structural Fill. Due to the organics encountered in hand auger borings K-1a, undercutting approximately 3 to 4 feet below existing grades should be anticipated in the vicinity of the boring prior to construction of pavements or placement of Structural Fill.

In the location of the existing ponds on site, prior to placement of fill or construction, approximately 12 to 24 inches of surface material may need to be mucked out. Actual undercut depends on the amount of organic silt encountered.

If the owner elects to leave the existing fill in-place, careful evaluations of the subgrade during construction should be considered critical to reducing the risk of unwanted post construction settlement. These evaluations may include proofrolling the subgrade soils, performing hand auger borings, and excavating test pits within previously filled areas. Localized remedial subgrade repairs should be anticipated. The mentioned evaluations would help in identifying soft, loose, or otherwise unsuitable areas of the fill, which would require remedial activities. Once the relevant facts to the nature of the undocumented fill are disclosed, the level of appropriate risk becomes a business decision that only the client can make.

5.2.2 Structural Fill

Prior to placement of Structural Fill, bulk samples (about 50 pounds) of on-site and/or off-site borrow should be submitted to ECS for laboratory testing, which typically include Atterberg limits, natural moisture content, grain-size distribution, and moisture-density relationships (i.e., Proctors) for compaction. Import materials should be tested prior to being hauled to the site to evaluate if they meet project specifications. Alternatively, Proctor data from other accredited laboratories can be submitted if the test results are within the last 90 days.

**Structural Fill Materials:** Materials selected for use as structural fill should consist of inorganic soils with the following engineering properties and compaction requirements.

STRUCTURAL FILL INDEX PROPERTIES	
Subject	Property
Building and Pavement Areas	LL < 40, PI<10
Max. Particle Size	3 inches
Fines Content	Max. 20 % < #200 sieve
Max. organic content	5% by dry weight

STRUCTURAL FILL COMPACTION REQUIREMENTS	
Subject	Requirement
Compaction Standard	Standard Proctor, ASTM D698
Required Compaction (upper 1 foot)	98% of Max. Dry Density
Required Compaction (depths greater than 1 foot)	95% of Max. Dry Density
Dry Unit Weight	>100 pcf
Moisture Content	-2 to +2 % points of the soil’s optimum value
Loose Thickness	8 inches prior to compaction

**On-Site Borrow Suitability:** Significant natural deposits of possible fill material are not present near surface on the site. The on-site sands (SM, SP-SM, SP) at depths greater than approximately 13 to 14 feet below existing grades with fines contents less than 20 percent and free of deleterious material should meet the recommendations for re-use as Structural Fill.

In the proposed stormwater pond, in the vicinity of the Geoprobe boring, G-1, the sands (SP-SM, SP) at depths of 13 feet to the depths explored of 24 feet should meet the recommendations for re-use as Structural Fill.

**Fill Placement:** Fill materials should not be placed on frozen soils, on frost-heaved soils, and/or on excessively wet soils. Borrow fill materials should not contain frozen materials at the time of placement, and frozen or frost-heaved soils should be removed prior to placement of structural fill or other fill soils and aggregates. Excessively wet soils or aggregates should be scarified, aerated, and moisture conditioned.

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### 5.3 FOUNDATION AND SLAB OBSERVATIONS

**Protection of Foundation Excavations:** Exposure to the environment may weaken the soils at the footing bearing level if the foundation excavations remain open for too long a time. Therefore, foundation concrete should be placed the same day that excavations are made. If the bearing soils are softened by surface water intrusion or exposure, the softened soils must be removed from the foundation excavation bottom immediately prior to placement of concrete. If the excavation must remain open overnight, or if rainfall becomes imminent while the bearing soils are exposed, a 1 to 3-inch thick “mud mat” of “lean” concrete should be placed on the bearing soils before the placement of reinforcing steel.

**Footing Subgrade Observations:** Some of the soils encountered on site at the foundation bearing elevation are anticipated to be adequate for support of the proposed structures. It is important to have ECS observe the foundation subgrade prior to placing foundation concrete, to confirm the bearing soils are what has been specified.

**Slab Subgrade Verification:** Prior to placement of a drainage layer, the subgrade should be prepared in accordance with the recommendations found in **Section 5.1.2 Proofrolling**.

### 5.4 UTILITY INSTALLATIONS

**Utility Subgrades:** The soils encountered in our exploration are expected to be generally not adequate for support of utility pipes. The pipe subgrades should be observed and probed for stability by ECS. Loose or unsteady materials encountered should be removed and replaced with compacted Structural Fill, or pipe stone bedding material.

**Utility Backfilling:** The granular bedding material (AASHTO #57 stone) should be 4 inches thick, but not less than that specified by the civil engineer’s project drawings and specifications. We recommend that the bedding materials be placed up to the springline of the pipe. Fill placed for support of the utilities, as well as backfill over the utilities, should meet the requirements for Structural Fill and fill placement.

**Excavation Safety:** Excavations and slopes should be constructed and maintained in accordance with OSHA excavation safety standards. The contractor is solely responsible for designing, constructing, and maintaining stable temporary excavations and slopes. The contractor’s Responsible Person, as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor’s safety procedures. The slope height, slope inclination, and excavation depth, including utility trench excavation depth, should not exceed those specified in local, state, and federal safety regulations. ECS is providing this information solely as a service to our client. ECS is not responsible for construction site safety or the contractor’s activities; such responsibility by ECS is not being implied and should not be inferred.

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## 6.0 CLOSING

ECS has prepared this report to guide the geotechnical-related design and construction aspects of the project. We performed these services in accordance with the standard of care expected of professionals in the industry performing similar services on projects of like size and complexity at this time in the region. No other representation, expressed or implied, and no warranty or guarantee is included or intended in this report.

The description of the proposed project is based on information provided to ECS by Brunswick Community College and Mr. Doug Sherwood with Sawyer, Sherwood & Associates Architecture. If this information is untrue or changes, either because of our interpretation of the documents provided or site or design changes that may occur later, ECS should be contacted so we can review our recommendations and provide additional or alternate recommendations that reflect the proposed construction.

We recommend that ECS review the project plans and specifications so we can confirm that those plans/specifications are in accordance with the recommendations of this geotechnical report.

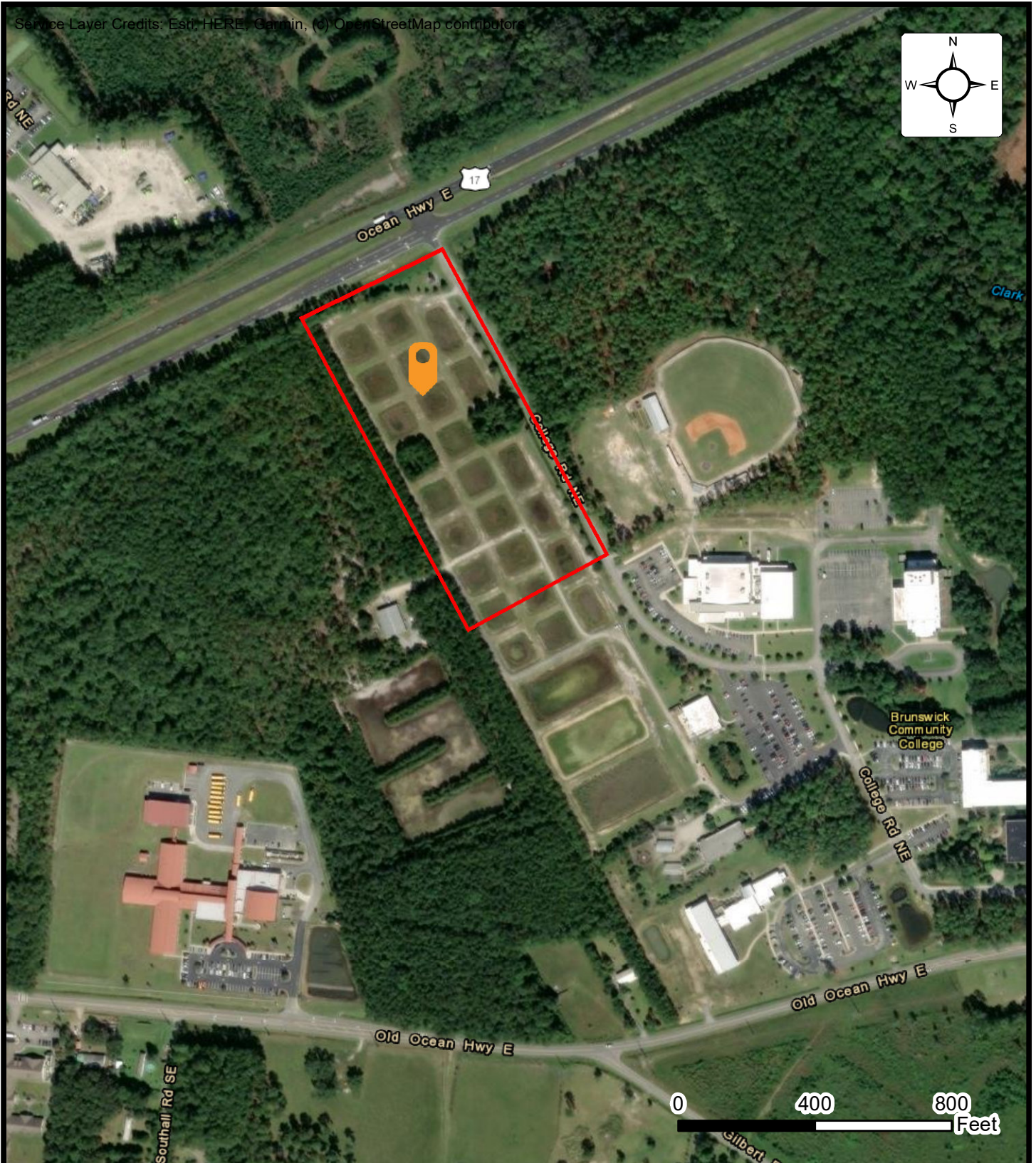
Field observations and quality assurance testing during earthwork and foundation installation are an extension of, and integral to, the geotechnical design. We recommend that ECS be retained to apply our expertise throughout the geotechnical phases of construction, and to provide consultation and recommendation should issues arise.

ECS is not responsible for the conclusions, opinions, or recommendations of others based on the data in this report.



**APPENDIX A – Diagrams & Reports**

- Site Location Diagram
- Exploration Location Diagram



## SITE LOCATION DIAGRAM BCC - PUBLIC SAFETY BUILDING

50 COLLEGE RD, BOLIVIA, NC  
BRUNSWICK COMMUNITY COLLEGE

ENGINEER  
WEG

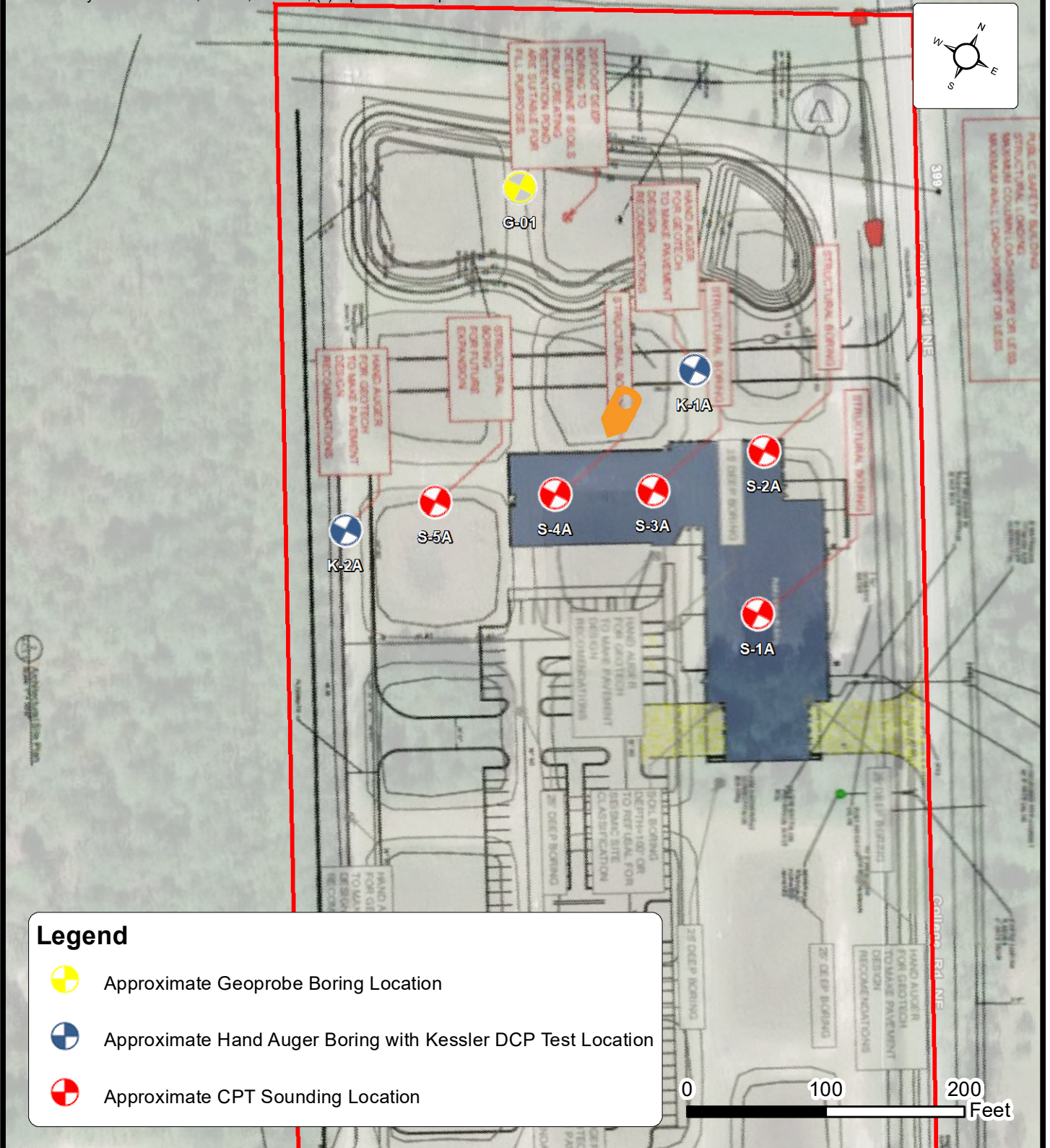
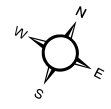
SCALE  
AS NOTED

PROJECT NO.  
22:34536

FIGURE  
1 OF 2

DATE  
4/25/2024





## Legend



Approximate Geoprobe Boring Location



Approximate Hand Auger Boring with Kessler DCP Test Location



Approximate CPT Sounding Location

0 100 200 Feet



# BORING LOCATION DIAGRAM BCC - PUBLIC SAFETY BUILDING

50 COLLEGE RD, BOLIVIA, NC

BRUNSWICK COMMUNITY COLLEGE

ENGINEER  
WEG

SCALE  
AS NOTED

PROJECT NO.  
22:34536

FIGURE  
2 OF 2

DATE  
4/25/2024

## **APPENDIX B – Field Operations**

Reference Notes for CPT Sounding Logs

Cone Penetration Test Sounding Logs (S-1a through S-5a)

Reference Notes for Boring Logs

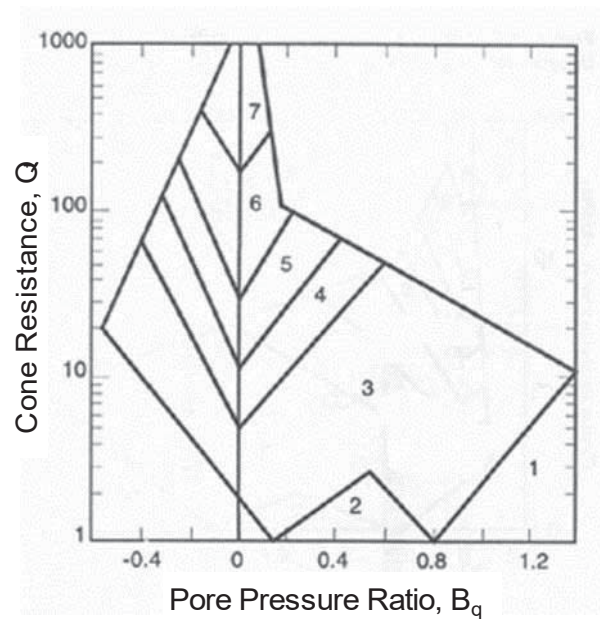
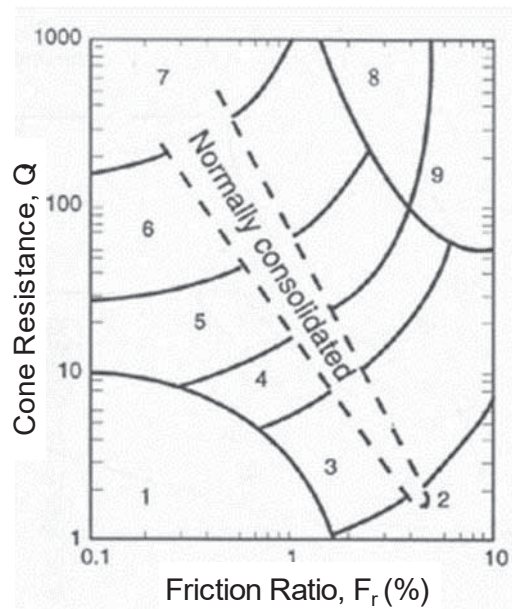
Hand Auger Boring Logs (K-1a and K-2a)

Kessler DCP Test Data (K-1a and K-2a)

Geoprobe Boring Log (G-1)

## REFERENCE NOTES FOR CONE PENETRATION TEST (CPT) SOUNDINGS

In the CPT sounding procedure (ASTM-D-5778), an electronically instrumented cone penetrometer is hydraulically advanced through soil to measure point resistance ( $q_c$ ), pore water pressure ( $u_2$ ), and sleeve friction ( $f_s$ ). These values are recorded continuously as the cone is pushed to the desired depth. CPT data is corrected for depth and used to estimate soil classifications and intrinsic soil parameters such as angle of internal friction, preconsolidation pressure, and undrained shear strength. The graphs below represent one of the accepted methods of CPT soil behavior classification (Robertson, 1990).



1. Sensitive, Fine Grained
2. Organic Soils-Peats
3. Clays; Clay to Silty Clay
4. Clayey Silt to Silty Clay
5. Silty Sand to Sandy Silt

6. Clean Sands to Silty Sands
7. Gravelly Sand to Sand
8. Very Stiff Sand to Clayey Sand
9. Very Stiff Fine Grained

The following table presents a correlation of corrected cone tip resistance ( $q_t$ ) to soil consistency or relative density:

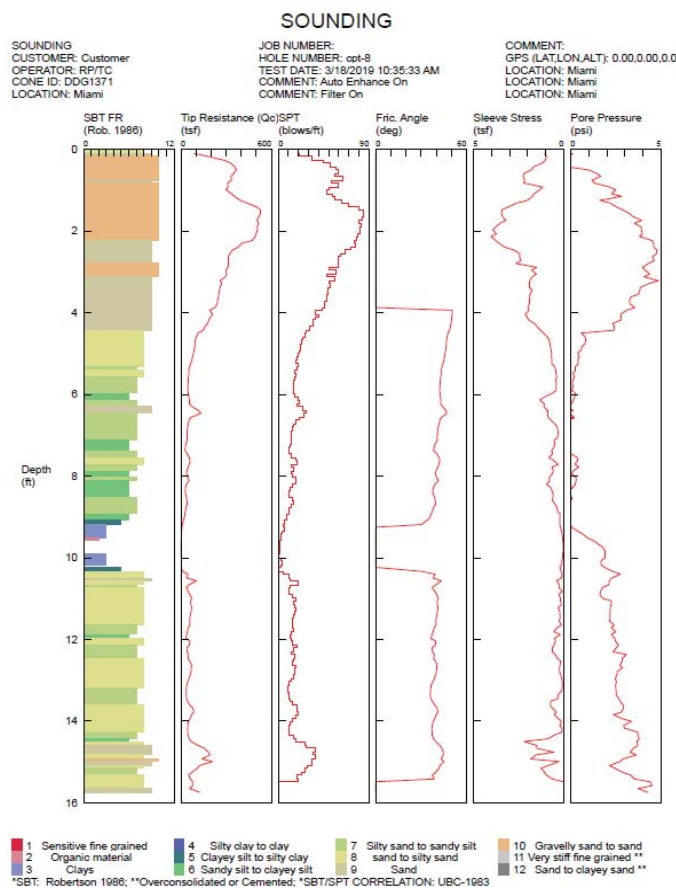
SAND		SILT/CLAY	
Corrected Cone Tip Resistance ( $q_t$ ) (tsf)	Relative Density	Corrected Cone Tip Resistance ( $q_t$ ) (tsf)	Relative Density
<20	Very Loose	<5	Very Soft
20-40	Loose	5-10	Soft
40-120	Medium Dense	10-15	Firm
		15-30	Stiff
120-200	Dense	30-45	Very Stiff
		45-60	Hard
>200	Very Dense	>60	Very Hard





## SUBSURFACE EXPLORATION PROCEDURE: CONE PENETRATION TESTING (CPT) ASTM D 5778

In the CPT sounding procedure, an electronically instrumented cone penetrometer is hydraulically advanced through soil to measure point resistance ( $q_c$ ), pore water pressure ( $U_2$ ), and sleeve friction ( $f_s$ ). These values are recorded continuously as the cone is pushed to the desired depth. CPT data is corrected for depth and used to estimate soil classifications and intrinsic soil parameters such as angle of internal friction, pre-consolidation pressure, and undrained shear strength.



### CPT Procedure:

- Involves the direct push of an electronically instrumented cone penetrometer\* through the soil
- Values are recorded continuously
- CPT data is corrected and correlated to soil parameters

\*CPT Penetrometer Size May Vary

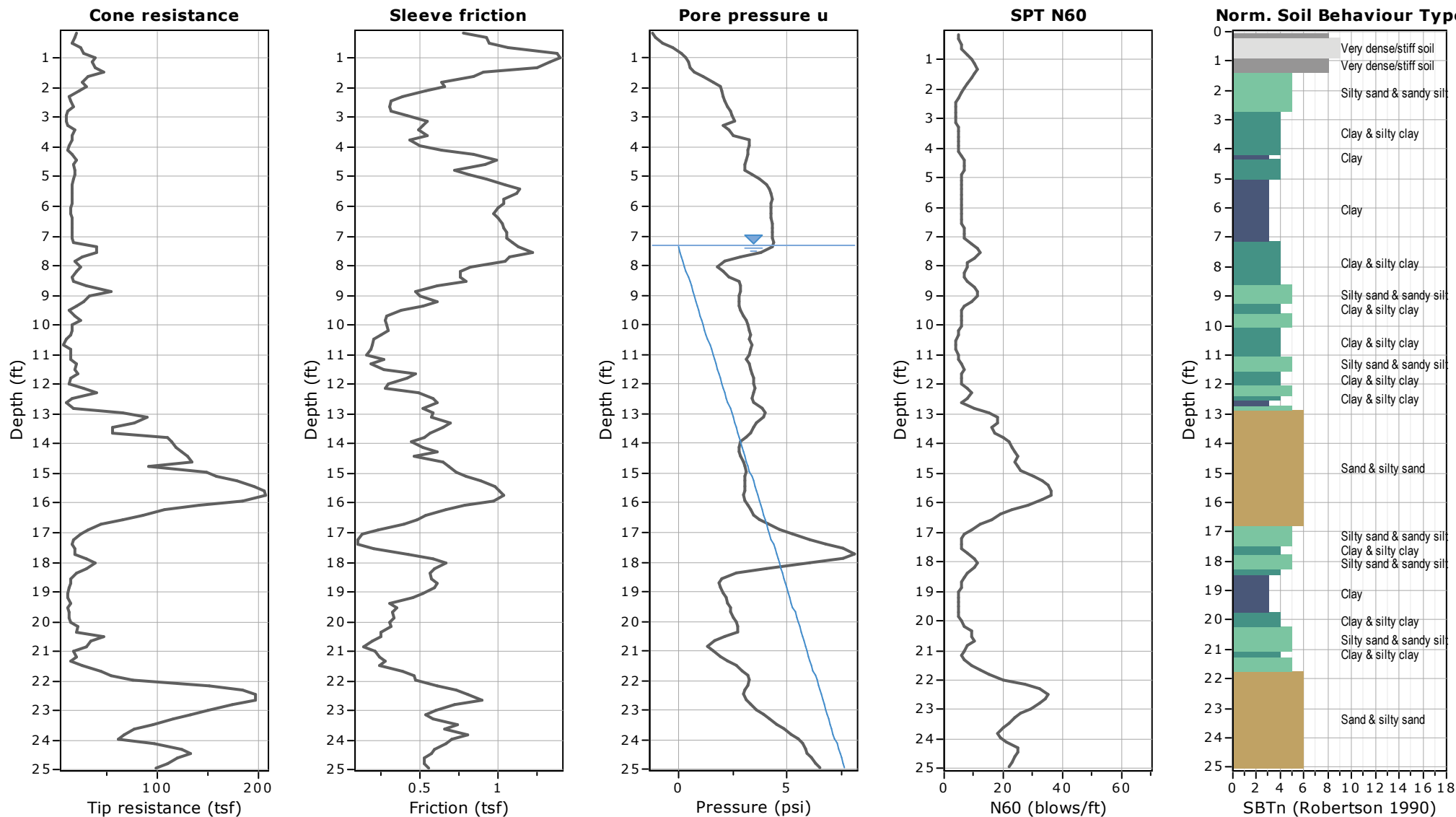


ECS Southeast, LLC  
6714 Netherlands Drive  
Wilmington, NC 28403  
ECS Project # 22-34536

Project: BCC - Public Safety Building Additional Geotech  
Location: Bolivia, Brunswick County, North Carolina

CPT: S-1a

Total depth: 24.93 ft, Date: 3/25/2024  
Cone Operator: Jared Duffy





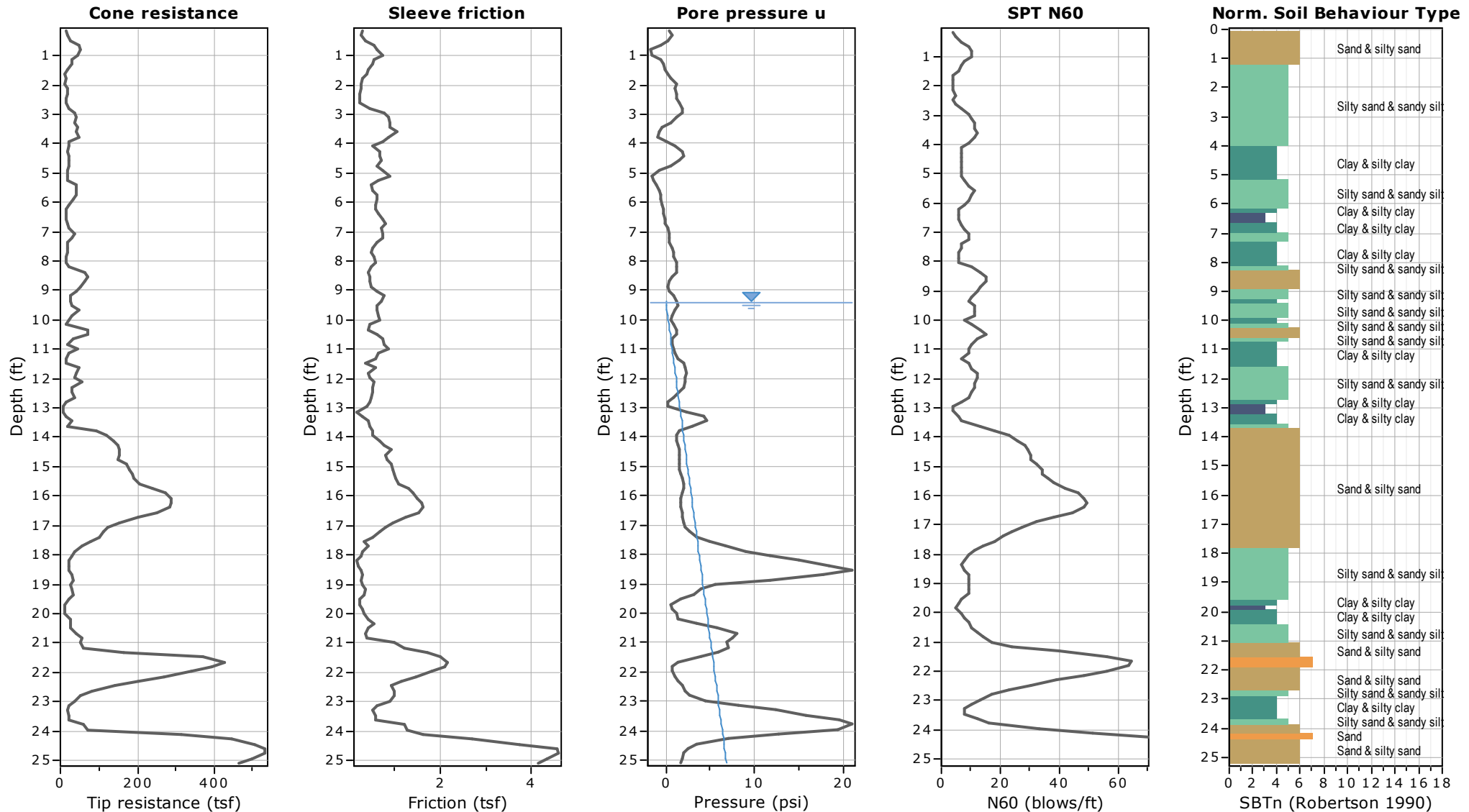
ECS Southeast, LLC  
6714 Netherlands Drive  
Wilmington, NC 28403  
ECS Project # 22-34536

Project: BCC - Public Safety Building Additional Geotech  
Location: Bolivia, Brunswick County, North Carolina

CPT: S-2a

Total depth: 25.10 ft, Date: 3/25/2024

Cone Operator: Jared Duffy





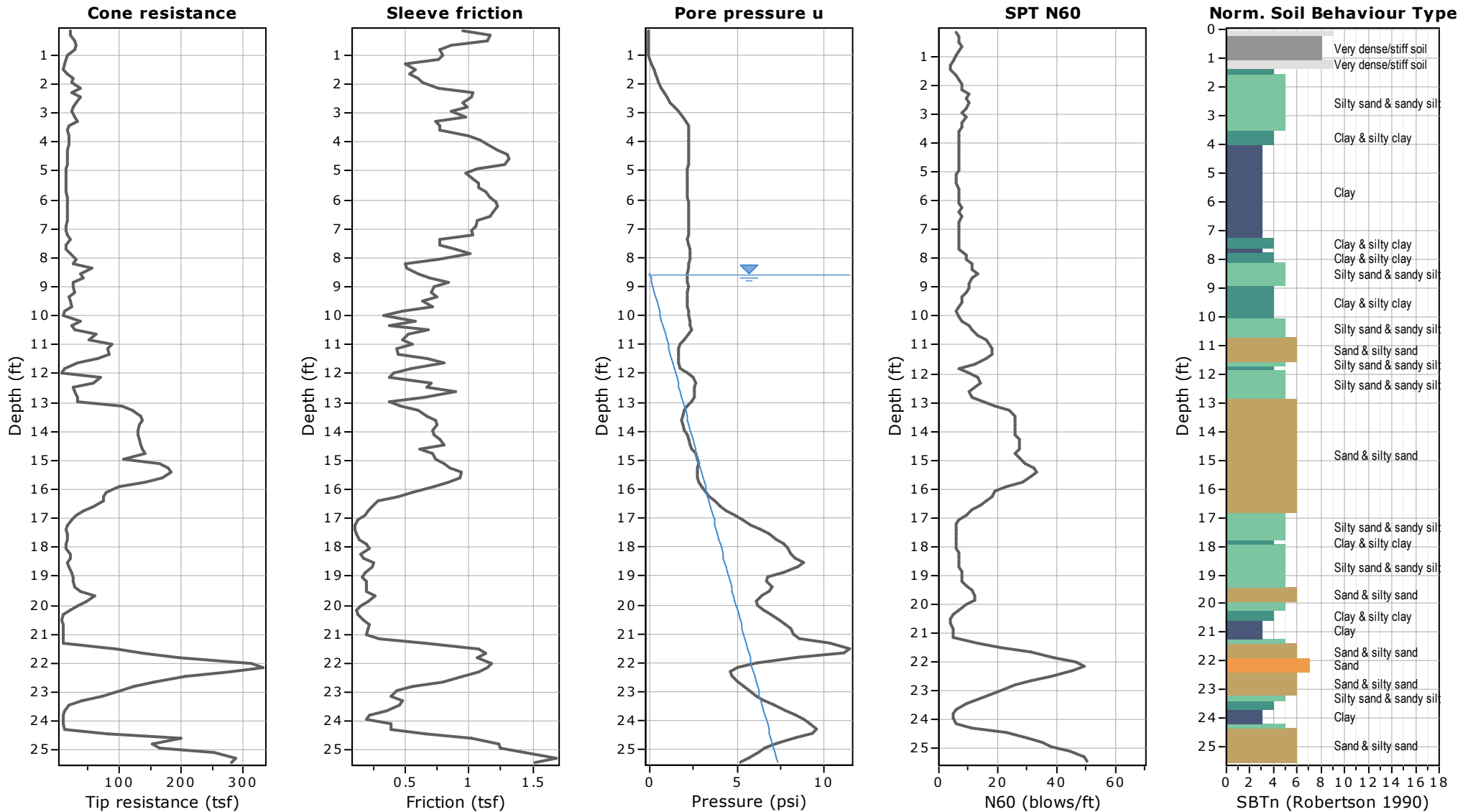


ECS Southeast, LLC  
6714 Netherlands Drive  
Wilmington, NC 28403  
ECS Project # 22-34536

Project: BCC - Public Safety Building Additional Geotech  
Location: Bolivia, Brunswick County, North Carolina

CPT: S-3a

Total depth: 25.43 ft, Date: 3/25/2024  
Cone Operator: Jared Duffy





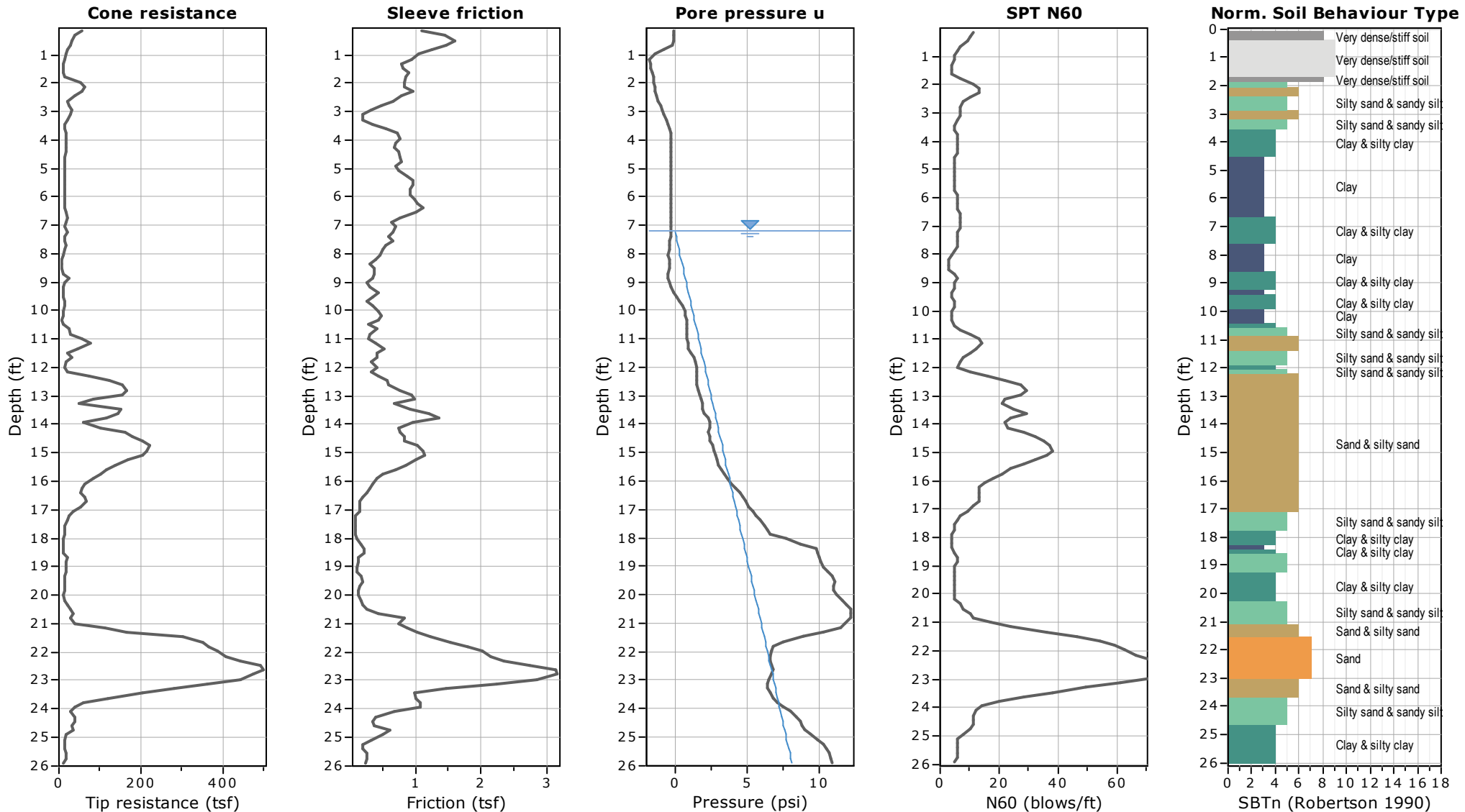
ECS Southeast, LLC  
6714 Netherlands Drive  
Wilmington, NC 28403  
ECS Project # 22-34536

Project: BCC - Public Safety Building Additional Geotech  
Location: Bolivia, Brunswick County, North Carolina

CPT: S-4a

Total depth: 25.92 ft, Date: 3/25/2024

Cone Operator: Jared Duffy





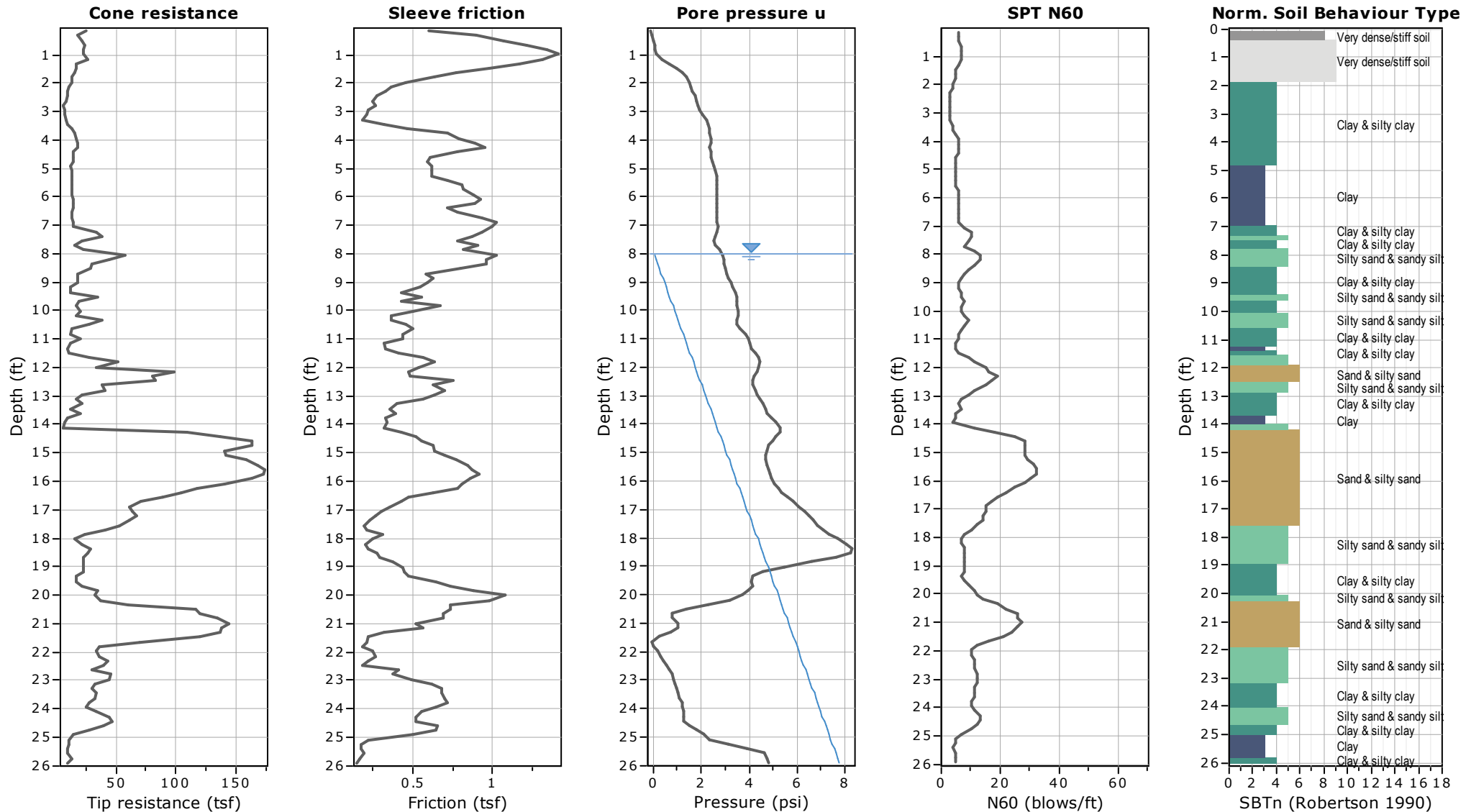
ECS Southeast, LLC  
6714 Netherlands Drive  
Wilmington, NC 28403  
ECS Project # 22-34536

Project: BCC - Public Safety Building Additional Geotech  
Location: Bolivia, Brunswick County, North Carolina

CPT: S-5a

Total depth: 25.92 ft, Date: 3/25/2024

Cone Operator: Jared Duffy





# REFERENCE NOTES FOR BORING LOGS

## MATERIAL<sup>1,2</sup>

	<b>ASPHALT</b>
	<b>CONCRETE</b>
	<b>GRAVEL</b>
	<b>TOPSOIL</b>
	<b>VOID</b>
	<b>BRICK</b>
	<b>AGGREGATE BASE COURSE</b>
	<b>GW WELL-GRADED GRAVEL</b> gravel-sand mixtures, little or no fines
	<b>GP POORLY-GRADED GRAVEL</b> gravel-sand mixtures, little or no fines
	<b>GM SILTY GRAVEL</b> gravel-sand-silt mixtures
	<b>GC CLAYEY GRAVEL</b> gravel-sand-clay mixtures
	<b>SW WELL-GRADED SAND</b> gravelly sand, little or no fines
	<b>SP POORLY-GRADED SAND</b> gravelly sand, little or no fines
	<b>SM SILTY SAND</b> sand-silt mixtures
	<b>SC CLAYEY SAND</b> sand-clay mixtures
	<b>ML SILT</b> non-plastic to medium plasticity
	<b>MH ELASTIC SILT</b> high plasticity
	<b>CL LEAN CLAY</b> low to medium plasticity
	<b>CH FAT CLAY</b> high plasticity
	<b>OL ORGANIC SILT or CLAY</b> non-plastic to low plasticity
	<b>OH ORGANIC SILT or CLAY</b> high plasticity
	<b>PT PEAT</b> highly organic soils

## DRILLING SAMPLING SYMBOLS & ABBREVIATIONS

SS	Split Spoon Sampler	PM	Pressuremeter Test
ST	Shelby Tube Sampler	RD	Rock Bit Drilling
WS	Wash Sample	RC	Rock Core, NX, BX, AX
BS	Bulk Sample of Cuttings	REC	Rock Sample Recovery %
PA	Power Auger (no sample)	RQD	Rock Quality Designation %
HSA	Hollow Stem Auger		

## PARTICLE SIZE IDENTIFICATION

DESIGNATION	PARTICLE SIZES
Boulders	12 inches (300 mm) or larger
Cobbles	3 inches to 12 inches (75 mm to 300 mm)
Gravel: Coarse	¾ inch to 3 inches (19 mm to 75 mm)
Fine	4.75 mm to 19 mm (No. 4 sieve to ¾ inch)
Sand: Coarse	2.00 mm to 4.75 mm (No. 10 to No. 4 sieve)
Medium	0.425 mm to 2.00 mm (No. 40 to No. 10 sieve)
Fine	0.074 mm to 0.425 mm (No. 200 to No. 40 sieve)
Silt & Clay ("Fines")	<0.074 mm (smaller than a No. 200 sieve)

## COHESIVE SILTS & CLAYS

UNCONFINED COMPRESSIVE STRENGTH, QP <sup>4</sup>	SPT <sup>5</sup> (BPF)	CONSISTENCY <sup>7</sup> (COHESIVE)
<0.25	<2	Very Soft
0.25 - <0.50	2 - 4	Soft
0.50 - <1.00	5 - 8	Firm
1.00 - <2.00	9 - 15	Stiff
2.00 - <4.00	16 - 30	Very Stiff
4.00 - 8.00	31 - 50	Hard
>8.00	>50	Very Hard

RELATIVE AMOUNT <sup>7</sup>	COARSE GRAINED (%) <sup>8</sup>	FINE GRAINED (%) <sup>8</sup>
Trace	≤5	≤5
With	10 - 20	10 - 25
Adjective (ex: "Silty")	25 - 45	30 - 45

## GRAVELS, SANDS & NON-COHESIVE SILTS

SPT <sup>5</sup>	DENSITY
<5	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
>50	Very Dense

## WATER LEVELS<sup>6</sup>

	WL (First Encountered)
	WL (Completion)
	WL (Seasonal High Water)
	WL (Stabilized)

## FILL AND ROCK

<b>FILL</b>	<b>POSSIBLE FILL</b>	<b>PROBABLE FILL</b>	<b>ROCK</b>

<sup>1</sup>Classifications and symbols per ASTM D 2488-17 (Visual-Manual Procedure) unless noted otherwise.

<sup>2</sup>To be consistent with general practice, "POORLY GRADED" has been removed from GP, GP-GM, GP-GC, SP, SP-SM, SP-SC soil types on the boring logs.

<sup>3</sup>Non-ASTM designations are included in soil descriptions and symbols along with ASTM symbol [Ex: (SM-FILL)].


<sup>4</sup>Typically estimated via pocket penetrometer or Torvane shear test and expressed in tons per square foot (tsf).

<sup>5</sup>Standard Penetration Test (SPT) refers to the number of hammer blows (blow count) of a 140 lb. hammer falling 30 inches on a 2 inch OD split spoon sampler required to drive the sampler 12 inches (ASTM D 1586). "N-value" is another term for "blow count" and is expressed in blows per foot (bpf). SPT correlations per 7.4.2 Method B and need to be corrected if using an auto hammer.

<sup>6</sup>The water levels are those levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in granular soils. In clay and cohesive silts, the determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally employed.

<sup>7</sup>Minor deviation from ASTM D 2488-17 Note 14.

<sup>8</sup>Percentages are estimated to the nearest 5% per ASTM D 2488-17.

CLIENT: Brunswick Community College	PROJECT NO.: 22:34536	SHEET: 1 of 1	
PROJECT NAME: BCC - Public Safety Building Additional Geotech	HAND AUGER NO.: K-01A	SURFACE ELEVATION:	
SITE LOCATION: 50 College Rd, Bolivia, North Carolina, 28422		STATION:	
LATITUDE:		LONGITUDE:	

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	SAMPLE NUMBER	FINES CONTENT (%)	MOISTURE CONTENT (%)
			(SM) SILTY FINE SAND, gray, moist, with gravel					
			(SC) CLAYEY FINE SAND, dark gray, moist					
			(CL) SANDY LEAN CLAY, gray, moist to saturated, with organics					
			END OF HAND AUGER AT 4 FT					
5		-5						

REMARKS:							
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL							
EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT							
▽ WL (First Encountered)		▼ WL (Seasonal High)		ECS REP:	DATE COMPLETED:	UNITS:	CAVE-IN-DEPTH:
▼ WL (Completion) 3.75				REG	Mar 26 2024	English	
HAND AUGER LOG							

## DCP TEST DATA

**Project:** *BBC- Public Safety Building Additional Geot*

Date: 26-Mar-24

**Location:** K-1A

Soil Type(s): SAND (SM, SC) CLAY (CL)

Hammer

☐ 10.1 lbs.

☒ 17.6 lbs.

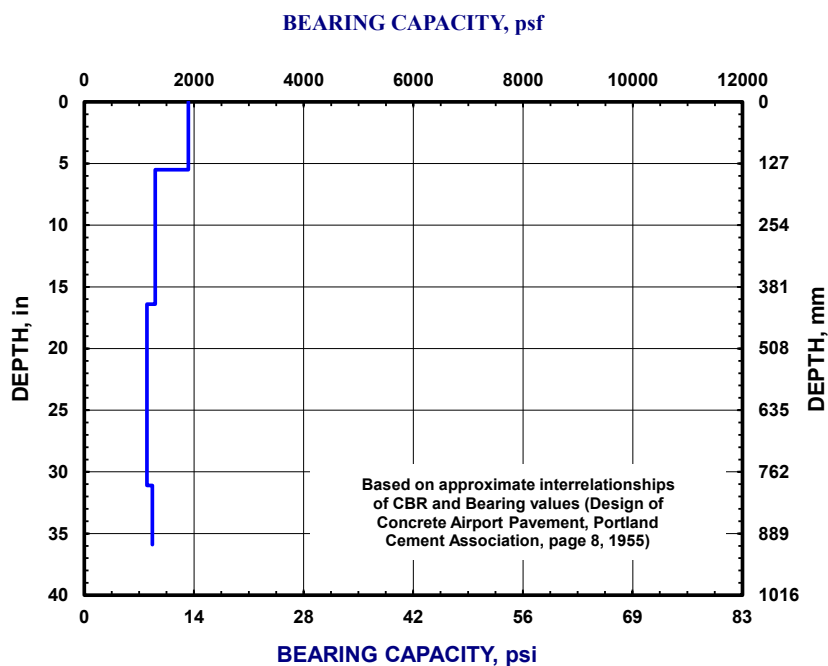
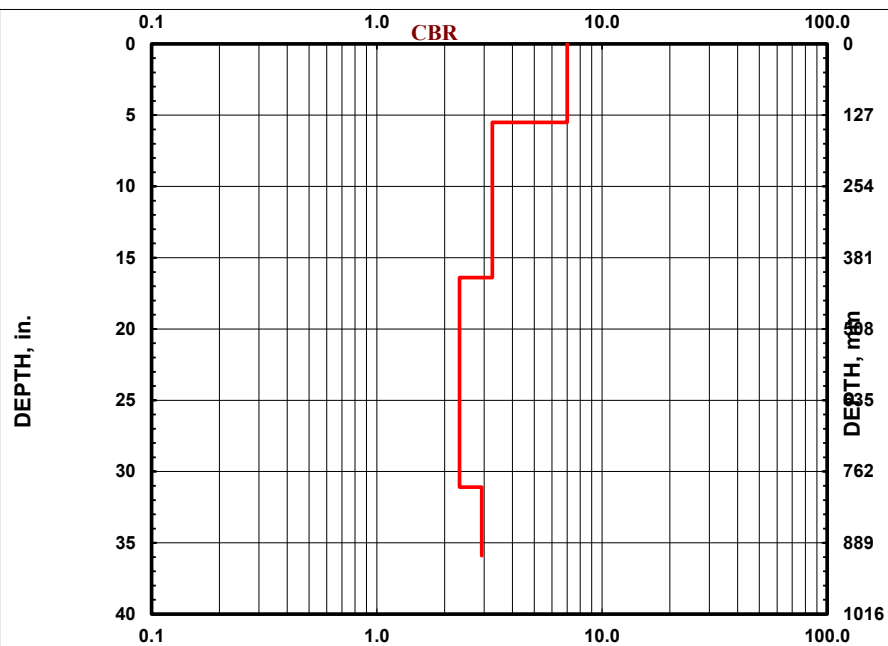
☐ Both hammers used

Soil Type

☐ CH

☐ CL

☒ All other soils

[illegible]

CLIENT:  
Brunswick Community College

PROJECT NO.:  
22:34536

SHEET:  
1 of 1

PROJECT NAME:  
BCC - Public Safety Building Additional Geotech

HAND AUGER NO.:  
K-02A

SURFACE ELEVATION:

SITE LOCATION:  
50 College Rd, Bolivia, North Carolina, 28422

STATION:

LATITUDE:

LONGITUDE:



DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	SAMPLE NUMBER	FINES CONTENT (%)	MOISTURE CONTENT (%)
			(SM) SILTY FINE SAND, gray, moist, with gravel					
			(CL) SANDY LEAN CLAY, tan/ gray, moist					
			(SM) SILTY FINE SAND, gray, moist					
			(SM) SILTY FINE SAND, gray, moist, with clay lenses					
			(CL) SANDY LEAN CLAY, tan/ gray, moist					
			END OF HAND AUGER AT 4 FT					
5		-5						

REMARKS:

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

☒ WL (First Encountered)

☒ WL (Seasonal High)

ECS REP:

DATE COMPLETED:

UNITS:

CAVE-IN-DEPTH:

☑ WL (Completion)

REG

Mar 26 2024

English

HAND AUGER LOG

## DCP TEST DATA

**Project:** *BBC- Public Safety Building Additional Geot*

Date: 26-Mar-24

**Location:** K-2A

Soil Type(s): SAND (SM) CLAY (CL)

Hammer

☐ 10.1 lbs.

☒ 17.6 lbs.

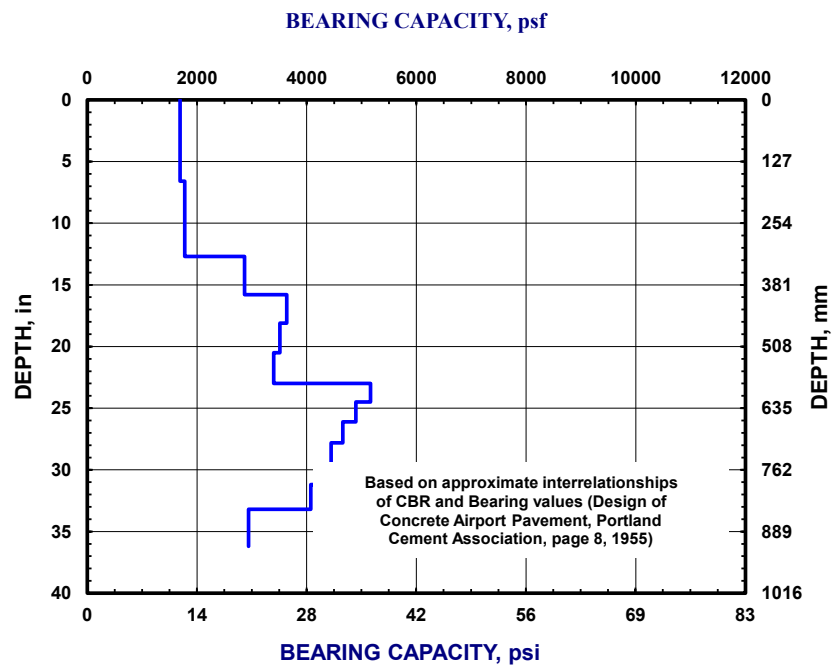
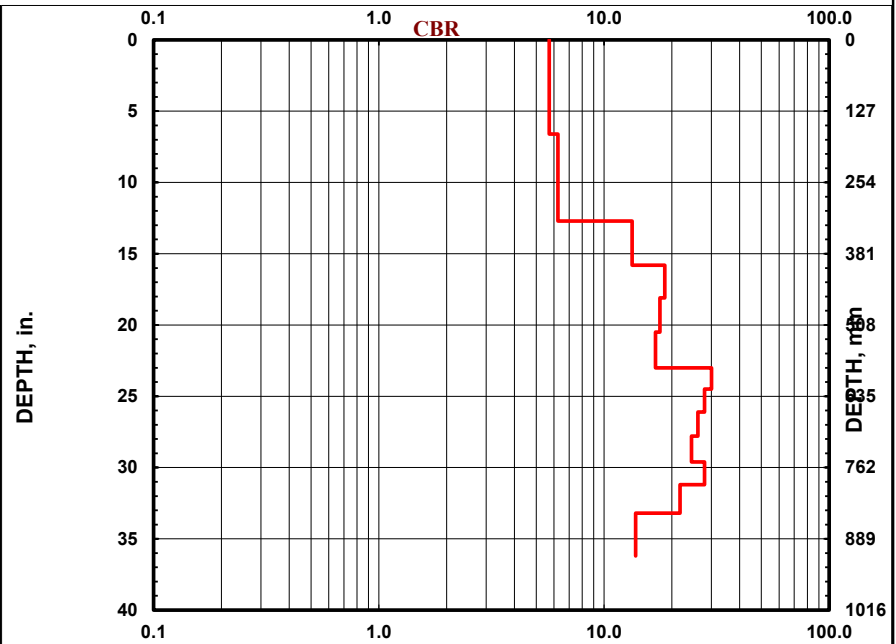
☐ Both hammers used

Soil Type


☐ CH

☐ CL

☒ All other soils

[illegible]



CLIENT: <b>Brunswick Community College</b>		PROJECT NO.: <b>22:34536</b>	SHEET: <b>1 of 1</b>	
PROJECT NAME: <b>BCC - Public Safety Building Additional Geotech</b>		GEOPROBE NO.: <b>G-01</b>	SURFACE ELEVATION:	
SITE LOCATION: <b>50 College Rd, Bolivia, North Carolina, 28422</b>			STATION:	
LATITUDE:		LONGITUDE:		

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (Tsf)	SAMPLE NUMBER	MOISTURE CONTENT (%)
			Topsoil Thickness[6.00"]					
			(CL) SANDY LEAN CLAY, gray, moist					
			(SM) SILTY FINE SAND, gray, moist, with clay lenses					
5		-5						
			(SC) CLAYEY FINE SAND, gray, moist					
			(CL) SANDY LEAN CLAY, gray/ orange, moist to wet					
	▼		(SC) CLAYEY SAND, tan, saturated					
10		-10						
			(SP) FINE SAND, white, saturated					
15		-15					S-1	19.4
			(SP-SM) FINE SAND WITH SILT, gray, saturated					
20		-20					S-2	24.6
			(SP-SM) FINE SAND WITH SILT, tan, saturated					
							S-3	23.2
			END OF GEOPROBE AT 24 FT					
25								

REMARKS:

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL			
EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT			
<div> <div>▼</div> WL (First Encountered) </div>	<div> <div>▼</div> WL (Seasonal High) </div>	CONTRACTOR:	OPERATOR:
<div> <div>▼</div> WL (Completion) </div>		<div> <div>8.00</div> </div>	<div> <div>Mid Atlantic Drilling, Inc.</div> </div>
MAKE/MODEL:			
ECS REP.:	DATE COMPLETED:	UNITS:	CAVE-IN-DEPTH:
	Mar 29 2024	English	
GEOPROBE LOG			

**APPENDIX C – Laboratory Testing**

Laboratory Testing Summary

## Laboratory Testing Summary

Sample Location	Sample Number	Depth (ft)	^MC (%)	Soil Type	Atterberg Limits			**Percent Passing No. 200 Sieve	Moisture - Density		CBR (%)		#Organic Content (%)
					LL	PL	PI		<Maximum Density (pcf)	<Optimum Moisture (%)	0.1 in.	0.2 in.	
G-01	S-1	15.0-16.0	19.4					2.6					
G-01	S-2	19.0-20.0	24.6					7.3					
G-01	S-3	22.0-23.0	23.2					9.1					

**Notes:** See test reports for test method, ^ASTM D2216-19, \*ASTM D2488, \*\*ASTM D1140-17, #ASTM D2974-20e1 < See test report for D4718 corrected values

**Definitions:** MC: Moisture Content, Soil Type: USCS (Unified Soil Classification System), LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index, CBR: California Bearing Ratio, OC: Organic Content

Project: BCC - Public Safety Building Additional Geotech  
Client: Brunswick Community College

Project No.: 22:34536  
Date Reported: 4/19/2024



Office / Lab

ECS Southeast LLC - Wilmington

Address

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Office Number / Fax

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(910)686-9666

Tested by	Checked by	Approved by	Date Received
		MYoung1	

## **APPENDIX D – Supplemental Report Documents**

GBA Document

# Important Information about This Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

**The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.**

## **Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects**

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled.* No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

## **Read this Report in Full**

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

## **You Need to Inform Your Geotechnical Engineer about Change**

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

## **This Report May Not Be Reliable**

*Do not rely on this report* if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be, and, in general, if you are the least bit uncertain about the continued reliability of this report, contact your geotechnical engineer before applying it.* A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

## **Most of the "Findings" Related in This Report Are Professional Opinions**

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

## This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

## This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

## Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may

perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

## Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

## Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old*.

## Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, *proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration*. Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. *Geotechnical engineers are not building-envelope or mold specialists*.



GEOPROFESSIONAL  
BUSINESS  
ASSOCIATION

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# ECS Southeast, LLC

Geotechnical Engineering Report

BCC – Public Safety Building

Bolivia, Brunswick County, North Carolina

ECS Project No. 22:33895

November 14, 2023







## ECS SOUTHEAST, LLC

Geotechnical • Construction Materials • Environmental • Facilities

NC Engineering License No. F-1519

November 14, 2023

Mr. Jack Luciano  
Brunswick Community College  
50 College Road NE  
Bolivia, North Carolina 28422

ECS Project No. 22:33895

Reference: Geotechnical Engineering Report  
**BCC – Public Safety Building**  
Bolivia, Brunswick County, North Carolina

Dear Mr. Luciano:

ECS Southeast, LLC (ECS) has finished the subsurface exploration and geotechnical engineering analyses for the above-referenced project. Our services were performed in general accordance with our agreed to scope of work. This report presents our understanding of the geotechnical aspects of the project along with the results of the field exploration and our design and construction recommendations.

It has been our pleasure to be of service to Brunswick Community College during the design phase of this project. We would appreciate the opportunity to remain involved during the continuation of the design phase, and we would like to provide our services during construction phase operations as well to verify subsurface conditions assumed for this report. Should you have questions concerning the information contained in this report, or if we can be of further assistance to you, please contact us.

Respectfully submitted,

**ECS Southeast, LLC**

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ECS New York Engineering, PLLC - An Associate of ECS Group of Companies • [www.ecslimited.com](http://www.ecslimited.com)

"ONE FIRM. ONE MISSION."



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## **APPENDICES**

### **Appendix A – Drawings & Reports**

- Site Location Diagram
- Exploration Location Diagram

### **Appendix B – Field Operations**

- Reference Notes for CPT Soundings
- Cone Penetration Test Sounding Logs (S-1 through S-6)
- Reference Notes for Boring Logs
- Hand Auger Boring Logs (K-1 through K-5)
- Kessler DCP Test Data (K-1 through K-5)

### **Appendix C – Supplemental Report Documents**

- GBA Document

---

## EXECUTIVE SUMMARY

The following summarizes the main findings of the exploration, particularly those that may have a cost impact on the planned development. Further, our principal foundation recommendations are summarized. Information gleaned from the Executive Summary should not be utilized in lieu of reading the geotechnical report.

- The geotechnical exploration performed for the site included six (6) electronic cone penetration test (CPT) soundings drilled to termination and refusal depths of approximately 25 to 52.5 feet. Five (5) Kessler dynamic cone penetrometer (DCP) tests with hand auger borings were performed in the proposed pavements.
- Provided the subgrades are prepared as recommended in this report and the column and wall loads do not exceed the anticipated loads provided in the table in **Section 2.2**, the planned structures may be supported by conventional shallow foundations consisting of column or strip footings bearing on compacted structural fill and natural soils using a net allowable soil bearing pressure of 1,500 psf.
- Groundwater was encountered in the soundings at depths ranging from approximately 2.5 feet to 9.4 feet below existing grade. Groundwater was not encountered in the hand auger borings K-1 through K-5 at the depths explored.
- Due to the near surface soft clays encountered in soundings S-3 and S-4, undercutting approximately 3 to 4 feet should be anticipated prior to construction of foundations or placement of Structural Fill.
- Due to the organics encountered in hand auger borings K-3 and K-5, undercutting approximately 3 feet below existing grades should be anticipated in the vicinity of the borings and due to the roots encountered near surface in hand auger boring K-2, undercutting approximately 1 foot in the vicinity of the boring should be anticipated prior to construction of pavements or placement of Structural Fill.
- Due to the near surface soft clays encountered in hand auger borings K-1 and K-4, undercutting approximately 18 to 24 inches below the pavement subgrades may be needed prior to construction of pavements.
- In the location of the existing ponds on site, prior to placement of fill or construction, approximately 12 to 24 inches of surface material may need to be mucked out. Actual undercut depends on the amount of organic silt encountered.

Please note this Executive Summary is an important part of this report and should be considered a **“summary”** only. The subsequent sections of this report constitute our findings, conclusions, and recommendations in their entirety.

---

## 1.0 INTRODUCTION

The purpose of this study was to provide geotechnical information for the design of foundations and pavements for the proposed building located at the Brunswick Community College campus at 50 College Road NE in Bolivia, North Carolina. The recommendations developed for this report are based on project information supplied by Mr. Jack Luciano with Brunswick Community College and Mr. Doug Sherwood with Sawyer, Sherwood & Associates Architecture.

Our services were provided in accordance with our Proposal No. 22:27931, dated October 16, 2023, as authorized by Brunswick Community College on October 16, 2023.

This report contains the procedures and results of our subsurface exploration programs, review of existing site conditions, engineering analyses, and recommendations for the design and construction of the project.

The report includes the following items.

- A brief review and description of our field test procedures and the results of testing conducted;
- A review of surface topographical features and site conditions;
- A review of subsurface soil stratigraphy with pertinent available physical properties;
- Foundation recommendations;
  - Allowable bearing pressure;
  - Settlement estimates (total and differential);
- Site development recommendations;
- Reusability of soils for use as fill material;
- Pavement design recommendations;
- Seismic site class and liquefaction recommendations;
- Discussion of groundwater impact;
- Compaction recommendations;
- Site vicinity map;
- Exploration location plan;
- Hand auger boring logs with Kessler DCP test results; and
- CPT sounding logs.

## 2.0 PROJECT INFORMATION

### 2.1 PROJECT LOCATION/CURRENT SITE USE/PAST SITE USE

The proposed site is located at the Brunswick Community College campus at 50 College Road NE in Bolivia, North Carolina. The site is bounded on the northeast by College Road NE, on the northwest and southeast by more existing basins, and on the southwest by wooded area. Figure 2.1.1 below shows an image of where the site is located.



**Figure 2.1.1 Site Location**

At the time of our exploration, the site currently consisted of a wooded area in the area of the proposed building and multiple existing basins. Based on our site visit, provided plans, and approximate elevations from Google Earth, the site has varying topography due to the existing basins and slopes down into a bowl in the wooded area with typical elevations on site ranging from approximately 43 to 48 feet.

### 2.2 PROPOSED CONSTRUCTION

The following information explains our understanding and assumptions of the planned development including proposed buildings and related infrastructure.

SUBJECT	DESIGN INFORMATION / ASSUMPTIONS
Usage	Education
Column Loads	Up to 100 kips
Wall Loads	Up to 3 kips per linear foot (klf)
Finish Floor Elevation	within +/- 4 feet of existing grades

ECS understands the project consists of construction of a new Public Safety building with associated paved drives and parking lots. ECS understands the footprint of the proposed building and parking lot and drives are within the footprints of existing basins.

### 3.0 FIELD EXPLORATION TESTING

Our exploration procedures are explained in greater detail in Appendix B including the Reference Notes for Cone Penetration Soundings. Our scope of work included performing six (6) CPT soundings and five (5) hand auger borings with Kessler DCP tests in the proposed pavements. Our approximate CPT soundings and hand auger boring locations are shown on the Exploration Location Diagram in Appendix A.

#### 3.1 SUBSURFACE CHARACTERIZATION

The subsurface conditions encountered were generally consistent with published geological mapping. The following sections provide generalized characterizations of the soil. Please refer to the CPT sounding and hand auger boring logs in Appendix B.

The site is located in the Coastal Plain Physiographic Province of North Carolina. The Coastal Plain is composed of seven terraces, each representing a former level of the Atlantic Ocean. Soils in this area generally consist of sedimentary materials transported from other areas by the ocean or rivers. These deposits vary in thickness from a thin veneer along the western edge of the region to more than 10,000 feet near the coast. The sedimentary deposits of the Coastal Plain rest upon consolidated rocks similar to those underlying the Piedmont and Mountain Physiographic Provinces. In general, shallow unconfined groundwater movement within the overlying soils is largely controlled by topographic gradients. Recharge occurs primarily by infiltration along higher elevations and typically discharges into streams or other surface water bodies. The elevation of the shallow water table is transient and can vary greatly with seasonal fluctuations in precipitation.

**Table 3.1.1 Subsurface Stratigraphy**

Approximate Depth Range	Stratum Description	Ranges of N*-Values(1) blows per foot (bpf)
0 to (0.25-0.5) (Surface cover)	N/A Topsoil was encountered on-site with an observed thickness of approximately 3 to 6 inches. <b>Deeper topsoil or organic laden soils are likely present in wet, poorly drained areas and potentially unexplored areas of the site such as the existing basins.</b>	N/A
(0.2-0.33) to 4	I Very Loose to Medium Dense, CLAYEY, SILTY, and CLEAN SAND (SC, SM, SP) and Very Soft to Firm, SANDY LEAN CLAY (CL) and ORGANICS (OL/OH)	1 to 29
4 to 12	II Soft to Stiff, SILTY, SANDY LEAN, and LEAN CLAY (CL-ML, CL) with interbedded layers of Loose to Medium Dense, SILTY and CLEAN SAND (SM, SP)	2 to 24
12 to 26	III Loose to Very Dense, SILTY TO CLEAN and CEMENTED SAND (SM, SP) with interbedded layers of Soft to Stiff, SILTY, SANDY LEAN, and LEAN CLAY (CL-ML, CL) and ORGANICS (OL/OH)	3 to 64
26 to 38	IV Loose to Medium Dense, SILTY TO CLEAN SAND (SM, SP)	8 to 14
38 to 51.5	V Soft to Stiff, SILTY and LEAN CLAY (CL-ML, CL)	4 to 9
51.5 to 52.5	VI Dense to Very Dense, SILTY TO CLEAN SAND (SM, SP)	47 to 80

Notes: (1) Equivalent Corrected Standard Penetration Test Resistances

---

### **3.2 GROUNDWATER OBSERVATIONS**

Water levels were encountered in our CPT soundings and are shown in Appendix B. Groundwater depths measured at the time of exploration ranged from approximately 2.5 to 9.4 feet below the ground surface. Groundwater was not encountered at the time of exploration in the hand auger borings, K-1 through K-5, at the depths explored. Variations in the long-term water table may occur as a result of changes in precipitation, evaporation, surface water runoff, construction activities, and other factors.

## 4.0 DESIGN RECOMMENDATIONS

### 4.1 SHALLOW FOUNDATIONS

Provided subgrades and structural fills are prepared as recommended in this report, the anticipated column and wall loads provided in **Section 2.2** are not exceeded, and the undercutting recommendations are followed, the proposed structure can be supported by shallow foundations including column footings and continuous wall footings. We recommend the foundation design use the following parameters:

Design Parameter	Column Footing	Wall Footing
Net Allowable Bearing Pressure <sup>(1)</sup>	1,500 psf	1,500 psf
Recommended Bearing Soil Material	Stratum I Soils or Structural Fill	Stratum I Soils or Structural Fill
Minimum Width	30 inches	18 inches
Minimum Footing Embedment Depth (below slab or finished grade) <sup>(2)</sup>	12 inches	12 inches
Minimum Exterior Frost Depth (below final exterior grade)	6 inches	6 inches
Estimated Total Settlement <sup>(3)</sup>	Less than 1- inch	Less than 1- inch
Estimated Differential Settlement <sup>(4)</sup>	Less than ½ inches between columns	Less than ½ inches

Notes:

- (1) Net allowable bearing pressure is the applied pressure in excess of the surrounding overburden soils above the base of the foundation.
- (2) For bearing considerations and frost penetration requirements.
- (3) Based on assumed structural loads. If final loads are different, ECS must be contacted to update foundation recommendations and settlement calculations.
- (4) Based on maximum column/wall loads and variability in borings. Differential settlement can be re-evaluated once the foundation plans are finished.

**Potential Undercuts:** Some of the soils at the estimated foundation bearing elevation are anticipated to be adequate for support of the proposed structures. If soft or loose soils are observed at the footing bearing elevations, the soils should be undercut and removed. Undercut should be backfilled with structural fill up to the original design bottom of footing elevation; the original footing may be constructed on top of the structural fill. Due to the near surface soft clays encountered in soundings S-3 and S-4, undercutting approximately 3 to 4 feet should be anticipated prior to construction of foundations or placement of Structural Fill. In the location of the existing ponds on site, prior to placement of fill or construction, approximately 12 to 24 inches of surface material may need to be mucked out. Actual undercut depends on the amount of organic silt encountered.

## 4.2 SLABS ON GRADE

The on-site natural soils are generally considered adequate for support of the slab-on-grade floor slabs. Based on the assumption that the finished floor elevation is around 48 feet, it appears that the slabs for the structure will likely bear on the Stratum I SAND (SC, SM) or Structural Fill. The following graphic depicts our soil-supported slab recommendations:

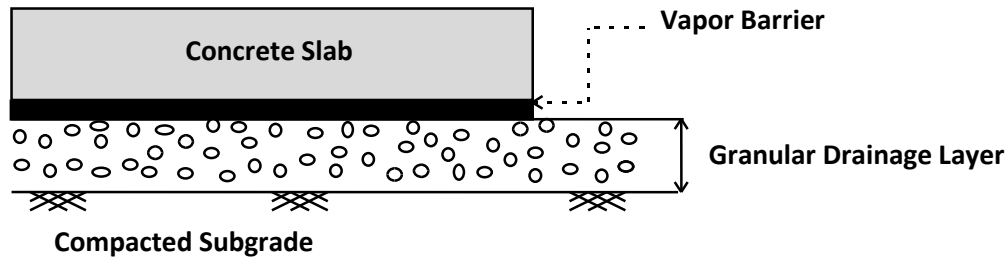


Figure 4.2.1

1. Drainage Layer Thickness: 6 inches
2. Drainage Layer Material: GRAVEL (GP) or SAND containing <5% fines passing #200 sieve (SP, SW)

Soft or yielding soils may be encountered in some areas. Those soils should be removed and replaced with compacted Structural Fill in accordance with the recommendations included in this report.

**Subgrade Modulus:** Provided the Structural Fill and Granular Drainage Layer are constructed in accordance with our recommendations, the slab may be designed assuming a modulus of subgrade reaction,  $k_1$  of 125 pci (lbs./cu. inch). The modulus of subgrade reaction value is based on a 1 ft by 1 ft plate load test basis.

**Vapor Barrier:** Before the placement of concrete, a vapor barrier may be placed on top of the granular drainage layer to provide additional protection against moisture vapor penetration through the floor slab. Curing of the slab should be performed in accordance with ACI specifications to reduce the potential for uneven drying, curling and/or cracking of the slab. Depending on proposed flooring material types, the structural engineer and/or the architect may choose to do away with the vapor barrier.

**Slab Isolation:** Soil-supported slabs should be isolated from the foundations and foundation-supported elements of the structure so that differential movement between the foundations and slab will not induce excessive shear and bending stresses in the floor slab. Where the structural configuration inhibits the use of a free-floating slab such as in a drop down footing/monolithic slab configuration, the slab should be designed to avoid overstressing of the slab.



#### 4.3 SEISMIC DESIGN CONSIDERATIONS

**Seismic Site Classification:** The ASCE7-16 standard requires site classification for seismic design based on the upper 100 feet of a soil profile. At least two methods are utilized in classifying sites, namely the shear wave velocity ( $v_s$ ) method and the Standard Penetration Resistance (N-value) method. The first method (shear wave velocity) was used in classifying this site.

Based upon our interpretation of the subsurface conditions, the appropriate Seismic Site Classification is “D.”

**Liquefaction:** When a saturated soil with little to approximately no cohesion liquefies during a major earthquake, it experiences a temporary loss of shear strength as a result of a transient rise in excess pore water pressure generated by strong ground motion. Flow failure, lateral spreading, differential settlement, loss of bearing, ground fissures, and sand boils are evidence of excess pore pressure generation and liquefaction.

The potential for liquefaction at the site is considered low based upon the CPT results and the liquefaction index procedure developed by Iwasaki (1982). Based on our CPT results and our evaluation using a site peak ground acceleration of 0.13 ( $PGA_m$ ) per ASCE7-16, an earthquake event with a magnitude of 7.3 and procedures developed by Moss et al. (2006) and Boulanger & Idriss (2014), the liquefaction induced settlement at the subject site is estimated to be approximately 1 inch or less. The max differential settlement is estimated to be 0.5 inches over a distance of 150 feet.

**Ground Motion Parameters:** In addition to the seismic site classification, ECS has evaluated the design spectral response acceleration parameters following the ASCE7-16 methodology. The Mapped Responses were estimated from the ATC Hazards by Location Tool available from the USGS website (<https://hazards.atcouncil.org>). The design responses for the short (0.2 sec,  $S_{DS}$ ) and 1-second period ( $S_{D1}$ ) are noted in bold at the far right end of the following table.

GROUND MOTION PARAMETERS – SITE CLASS D [ASCE7-16 Method]								
Period (sec)	Mapped Spectral Response Accelerations (g)		Values of Site Coefficient for Site Class		Maximum Spectral Response Acceleration Adjusted for Site Class (g)		Design Spectral Response Acceleration (g)	
Reference	Figures 1613.3.1 (1) & (2)		Tables 1613.3.3 (1) & (2)		Eqs. 16-37 & 16-38		Eqs. 16-39 & 16-40	
0.2	$S_s$	0.188	$F_a$	1.6	$S_{MS}=F_a S_s$	0.301	$S_{DS}=2/3 S_{MS}$	<b>0.201</b>
1.0	$S_1$	0.078	$F_v$	2.4	$S_{M1}=F_v S_1$	0.188	$S_{D1}=2/3 S_{M1}$	<b>0.125</b>

The Site Class definition should not be confused with the Seismic Design Category designation which the Structural Engineer typically assesses.

#### 4.4 PAVEMENTS

**Subgrade Characteristics:** Based on the results of our hand auger borings, it appears that the pavement subgrades will likely consist mainly of SAND (SC, SM) or Structural Fill.

Due to the organics encountered in hand auger borings K-3 and K-5, undercutting approximately 3 feet below existing grades should be anticipated in the vicinity of the borings and due to the roots encountered near surface in hand auger boring K-2, undercutting approximately 1 foot in the vicinity of the boring should be anticipated prior to construction of pavements or placement of Structural Fill. Due to the near surface soft clays encountered in hand auger borings K-1 and K-4, undercutting approximately 18 to 24 inches below the pavement subgrades may be needed prior to construction of pavements. In the location of the existing ponds on site, prior to placement of fill or construction, approximately 12 to 24 inches of surface material may need to be mucked out. Actual undercut depends on the amount of organic silt encountered.

California Bearing Ratio (CBR) values were estimated from the Kessler DCP tests performed on site adjacent to the hand auger borings. For preliminary design purposes, provided subgrade preparation and undercutting recommendations are followed, we recommend assuming a preliminary CBR value of 10.

We were not provided traffic loading information, so we have assumed loadings typical of this type of project. Our recommended pavement sections are based on up to 25,000 ESALs over a 20 year design life for light duty and up to 125,000 ESALs over a 20 year design life for heavy duty.

The preliminary pavement sections below are guidelines that may or may not comply with local jurisdictional minimums.

MATERIAL	PRELIMINARY PAVEMENT SECTIONS			
	FLEXIBLE PAVEMENT		RIGID PAVEMENT	
	Heavy Duty	Light Duty	Heavy Duty	Light Duty
Portland Cement Concrete ( $f'_c = 4,500$ psi)	-	-	6 in.	5 in.
Asphalt Surface Course	3 in.	2 in.	-	-
Aggregate Base Course (ABC)	8 in.	6 in.	4 in.	4 in.

In general, heavy duty sections are areas that will likely be subjected to trucks, buses, or other similar vehicles including main drive lanes of the development. Light duty sections are appropriate for vehicular traffic and parking areas.

Large, front loading trash dumpsters frequently impose concentrated front wheel loads on pavements during loading. This type of loading typically results in rutting of asphalt pavement and ultimately pavement failures. For preliminary design purposes, we recommend that the pavement in trash pickup areas consist of a 6-inch thick, 4,500 psi, reinforced concrete slab overlying 4 inches of ABC stone. When traffic loading becomes available, ECS or the Civil Engineer can design the pavements.

Prior to subbase placement and paving, CBR testing of the subgrade soils (both natural and fill soils) should be performed to evaluate the soil engineering properties for final pavement design. A minimum distance of 18 inches should be maintained between the bottom of the pavement section and the groundwater table.

The soil subgrade should be smooth-rolled and proofrolled prior to ABC placement. Areas that pump, rut, or are otherwise unstable should be re-compacted or undercut and replaced. The ABC should conform to the gradation, liquid limit, plasticity index, resistance to abrasion, and soundness per Section 1005 of the 2024 NCDOT Standard Specifications for Roads and Structures.

The ABC should be placed and be compacted in accordance with Section 520 of the 2024 NCDOT Standard Specifications for Roads and Structures. The ABC should be placed in a single lift. It should be spread after end-dumping on previously-placed ABC to deter rutting and degradation of the relatively clean sand subgrade soils by rubber-tired dump trucks. The ABC should be compacted to at least 98 percent of its Modified Proctor maximum dry unit weight per ASTM D1557 or AASHTO T180 (as modified by NCDOT), provided nuclear density testing is performed. Otherwise, at least 100 percent compaction is recommended.

To confirm that the specified degree of compaction is being obtained, field compaction testing should be performed in each ABC lift by ECS' representative. We recommend that compaction tests be performed at a minimum frequency of one test per 5,000 square feet per lift in pavement areas.

**Minimum Material Lift Thickness:** The minimum lift thickness for asphalt surface course mix S9.5B is 1.0 inch and the maximum lift thickness for S9.5B is 1.5 inches. For sections with more than 1.5 inches of S9.5B surface asphalt, it should be placed in two lifts. Asphalt pavement S9.5B should be compacted to least 90.0 percent of the material's specific gravity  $G_{mm}$ .

**Drainage:** An important consideration with the design and construction of pavements is surface and subsurface drainage. Where standing water develops, either on the pavement surface or within the aggregate base course layer, softening of the subgrades and other problems related to the deterioration of the pavement can be expected. This is particularly important at the site due to the moisture sensitive near-surface soils. Furthermore, good drainage should help reduce the possibility of the subgrade materials becoming saturated during the normal service period of the pavement.

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## 5.0 SITE CONSTRUCTION RECOMMENDATIONS

### 5.1 SUBGRADE PREPARATION

#### 5.1.1 Stripping and Grubbing

The subgrade preparation should consist of stripping vegetation, rootmat, topsoil, existing fill, existing foundations, existing pavements, and soft or loose materials from the 10-foot expanded building and 5-foot expanded pavement limits. The soundings and borings performed in “undisturbed” areas of the site contained an observed thickness of approximately 3 to 6 inches of topsoil. Deeper topsoil or organic laden soils may be present in wet, low-lying, and poorly drained areas. In the location of the existing ponds on site, prior to placement of fill or construction, approximately 12 to 24 inches of surface material may need to be mucked out. Actual undercut depends on the amount of organic silt encountered. ECS should be retained to verify that topsoil, existing foundations and pavements, construction debris, and substandard surficial materials have been removed prior to the placement of structural fill or construction of structures.

#### 5.1.2 Proofrolling

Prior to fill placement or other construction on subgrades, the subgrades should be evaluated by an ECS field technician. The exposed subgrade should be proofrolled with construction equipment having a minimum axle load of 10 tons [e.g., tandem-axle dump truck loaded to capacity]. Proofrolling should be traversed in two perpendicular directions with overlapping passes of the vehicle under the observation of an ECS technician. This procedure is intended to assist in identifying localized yielding materials.

Where proofrolling identifies areas that are unsteady or “pumping” subgrade those areas should be repaired prior to the placement of subsequent Structural Fill or other construction materials. Methods of stabilization include undercutting and moisture conditioning. The situation should be discussed with ECS to evaluate the appropriate procedure. Test pits may be excavated to explore the shallow subsurface materials to help in evaluating the cause of the observed unsteady materials, and to assist in the evaluation of appropriate remedial actions to stabilize the subgrade.

Due to the near surface soft clays encountered in soundings S-3 and S-4, undercutting approximately 3 to 4 feet should be anticipated prior to construction of foundations or placement of Structural Fill. Due to the organics encountered in hand auger borings K-3 and K-5, undercutting approximately 3 feet below existing grades should be anticipated in the vicinity of the borings and due to the roots encountered near surface in hand auger boring K-2, undercutting approximately 1 foot in the vicinity of the boring should be anticipated prior to construction of pavements or placement of Structural Fill. Due to the near surface soft clays encountered in hand auger borings K-1 and K-4, undercutting approximately 18 to 24 inches below the pavement subgrades may be needed prior to construction of pavements.

In the location of the existing ponds on site, prior to placement of fill or construction, approximately 12 to 24 inches of surface material may need to be mucked out. Actual undercut depends on the amount of organic silt encountered.

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## 5.2 EARTHWORK OPERATIONS

### 5.2.1 Existing Man-Placed Fill

**Risk Associated with Undocumented Fill:** Undocumented fill poses risks associated with undetected deleterious inclusions or soft zones within the fill and/or deleterious materials at the virgin ground/fill interface that are covered by the fill. Based on available historical imagery and information provided, ECS understands the site has been modified previously therefore there is possible fill on the site and the fill must be considered undocumented as we have not been provided with in-place density test results for the fill or documentation of the preparation of the soil subgrade prior to fill placement.

The magnitude of settlement or subsidence associated with undocumented fill is generally related to the degree of compaction applied to the fill, inclusions of deleterious materials, and previous loadings. Therefore, when undocumented fill is present, soil test borings can indicate generally favorable conditions when, in fact, undiscovered pockets of deleterious materials can exist under the proposed building or paved drive and parking areas. After the structure has been in place for some time, the extra load, or pressure, caused by new facility or new fill construction on the undocumented fill causes subsidence and consolidation. This subsidence and consolidation is reflected in settlement, sometimes excessive, in the paved surfaces or in the structure. The only way to totally eliminate the risk associated with undocumented fill is to remove it, exposing the original ground and allowing evaluation of the quality of the material in the fill volume.

We are not necessarily recommending the complete removal and replacement of the existing fill. However, the owner should understand that there is an inherent risk of constructing over undocumented fill, as localized areas of compressible soils, nested boulders, or buried debris can be present between the boring locations and can go unnoticed during the geotechnical study or during construction. Ultimately, the decision to build on undocumented fill is an economic decision that only the owner can make relative to the level of risk they consider acceptable should the new construction experience subgrade-related distress (e.g. building settlement, premature pavement distress, etc.). It has been our experience on comparable sites that this risk can be managed by performing monitoring and testing during construction, as described in this report.

If the owner elects to leave the existing fill in-place, careful evaluations of the subgrade during construction should be considered critical to reducing the risk of unwanted post construction settlement. These evaluations may include proofrolling the subgrade soils, performing hand auger borings, and excavating test pits within previously filled areas. Localized remedial subgrade repairs should be anticipated. The mentioned evaluations would help in identifying soft, loose, or otherwise unsuitable areas of the fill, which would require remedial activities. Once the relevant facts to the nature of the undocumented fill are disclosed, the level of appropriate risk becomes a business decision that only the client can make.

### 5.2.2 Structural Fill

Prior to placement of Structural Fill, bulk samples (about 50 pounds) of on-site and/or off-site borrow should be submitted to ECS for laboratory testing, which typically include Atterberg limits, natural moisture content, grain-size distribution, and moisture-density relationships (i.e., Proctors) for compaction. Import materials should be tested prior to being hauled to the site to evaluate if they meet project specifications. Alternatively, Proctor data from other accredited laboratories can be submitted if the test results are within the last 90 days.

**Structural Fill Materials:** Materials selected for use as structural fill should consist of inorganic soils with the following engineering properties and compaction requirements.

STRUCTURAL FILL INDEX PROPERTIES	
Subject	Property
Building and Pavement Areas	LL < 40, PI<10
Max. Particle Size	3 inches
Fines Content	Max. 20 % < #200 sieve
Max. organic content	5% by dry weight

STRUCTURAL FILL COMPACTION REQUIREMENTS	
Subject	Requirement
Compaction Standard	Standard Proctor, ASTM D698
Required Compaction (upper 1 foot)	98% of Max. Dry Density
Required Compaction (depths greater than 1 foot)	95% of Max. Dry Density
Dry Unit Weight	>100 pcf
Moisture Content	-2 to +2 % points of the soil's optimum value
Loose Thickness	8 inches prior to compaction

**On-Site Borrow Suitability:** Significant natural deposits of possible fill material are not present near surface on the site. The on-site sands (SM, SP) at depths greater than approximately 15 feet below existing grades with fines contents less than 20 percent and free of deleterious material should meet the recommendations for re-use as Structural Fill.

**Fill Placement:** Fill materials should not be placed on frozen soils, on frost-heaved soils, and/or on excessively wet soils. Borrow fill materials should not contain frozen materials at the time of placement, and frozen or frost-heaved soils should be removed prior to placement of structural fill or other fill soils and aggregates. Excessively wet soils or aggregates should be scarified, aerated, and moisture conditioned.

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### 5.3 FOUNDATION AND SLAB OBSERVATIONS

**Protection of Foundation Excavations:** Exposure to the environment may weaken the soils at the footing bearing level if the foundation excavations remain open for too long a time. Therefore, foundation concrete should be placed the same day that excavations are made. If the bearing soils are softened by surface water intrusion or exposure, the softened soils must be removed from the foundation excavation bottom immediately prior to placement of concrete. If the excavation must remain open overnight, or if rainfall becomes imminent while the bearing soils are exposed, a 1 to 3-inch thick “mud mat” of “lean” concrete should be placed on the bearing soils before the placement of reinforcing steel.

**Footing Subgrade Observations:** Some of the soils encountered on site at the foundation bearing elevation are anticipated to be adequate for support of the proposed structures. It is important to have ECS observe the foundation subgrade prior to placing foundation concrete, to confirm the bearing soils are what has been specified.

**Slab Subgrade Verification:** Prior to placement of a drainage layer, the subgrade should be prepared in accordance with the recommendations found in **Section 5.1.2 Proofrolling**.

### 5.4 UTILITY INSTALLATIONS

**Utility Subgrades:** The soils encountered in our exploration are expected to be generally not adequate for support of utility pipes. The pipe subgrades should be observed and probed for stability by ECS. Loose or unsteady materials encountered should be removed and replaced with compacted Structural Fill, or pipe stone bedding material.

**Utility Backfilling:** The granular bedding material (AASHTO #57 stone) should be 4 inches thick, but not less than that specified by the civil engineer’s project drawings and specifications. We recommend that the bedding materials be placed up to the springline of the pipe. Fill placed for support of the utilities, as well as backfill over the utilities, should meet the requirements for Structural Fill and fill placement.

**Excavation Safety:** Excavations and slopes should be constructed and maintained in accordance with OSHA excavation safety standards. The contractor is solely responsible for designing, constructing, and maintaining stable temporary excavations and slopes. The contractor’s Responsible Person, as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor’s safety procedures. The slope height, slope inclination, and excavation depth, including utility trench excavation depth, should not exceed those specified in local, state, and federal safety regulations. ECS is providing this information solely as a service to our client. ECS is not assuming responsibility for construction site safety or the contractor’s activities; such responsibility is not being implied and should not be inferred.

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## 6.0 CLOSING

ECS has prepared this report to guide the geotechnical-related design and construction aspects of the project. We performed these services in accordance with the standard of care expected of professionals in the industry performing similar services on projects of like size and complexity at this time in the region. No other representation, expressed or implied, and no warranty or guarantee is included or intended in this report.

The description of the proposed project is based on information provided to ECS by Mr. Jack Luciano with Brunswick Community College and Mr. Doug Sherwood with Sawyer, Sherwood & Associates Architecture. If this information is untrue or changes, either because of our interpretation of the documents provided or site or design changes that may occur later, ECS should be contacted so we can review our recommendations and provide additional or alternate recommendations that reflect the proposed construction.

We recommend that ECS review the project plans and specifications so we can confirm that those plans/specifications are in accordance with the recommendations of this geotechnical report.

Field observations and quality assurance testing during earthwork and foundation installation are an extension of, and integral to, the geotechnical design. We recommend that ECS be retained to apply our expertise throughout the geotechnical phases of construction, and to provide consultation and recommendation should issues arise.

ECS is not responsible for the conclusions, opinions, or recommendations of others based on the data in this report.



## **APPENDIX A – Diagrams & Reports**

Site Location Diagram  
Exploration Location Diagram



# SITE LOCATION DIAGRAM BCC - PUBLIC SAFETY BUILDING

50 COLLEGE RD NE, BOLIVIA, NC  
BRUNSWICK COMMUNITY COLLEGE

ENGINEER  
WEG

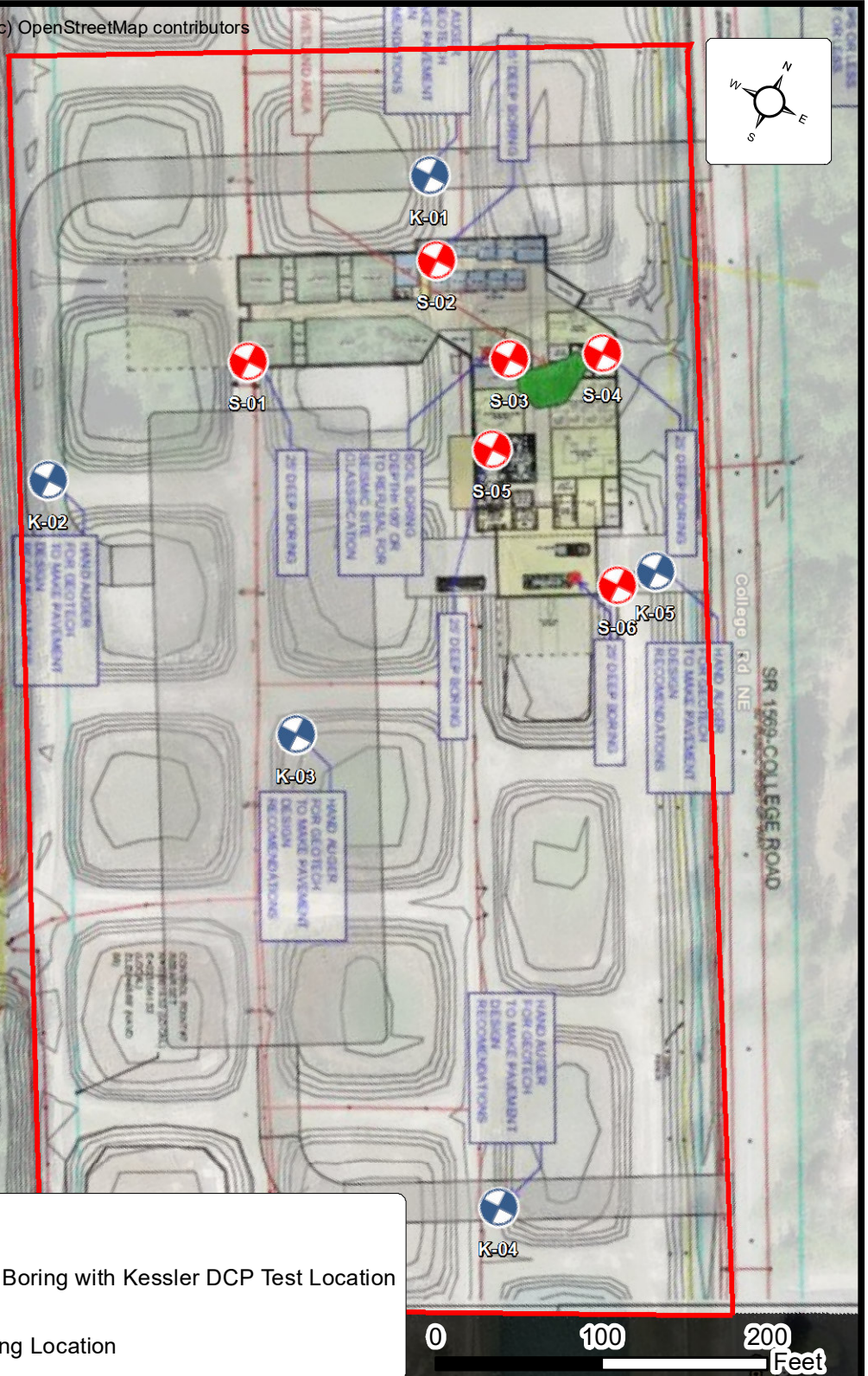
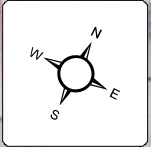
SCALE  
AS NOTED

PROJECT NO.  
22:33895

FIGURE  
1 OF 2

DATE  
11/8/2023





## Legend



Approximate Hand Auger Boring with Kessler DCP Test Location



Approximate CPT Sounding Location



# BORING LOCATION DIAGRAM BCC - PUBLIC SAFETY BUILDING

50 COLLEGE RD NE, BOLIVIA, NC  
BRUNSWICK COMMUNITY COLLEGE

ENGINEER  
WEG

SCALE  
AS NOTED

PROJECT NO.  
22:33895

FIGURE  
2 OF 2

DATE  
11/8/2023

## **APPENDIX B – Field Operations**

Reference Notes for CPT Sounding Logs

Cone Penetration Test Sounding Logs (S-1 through S-6)

Reference Notes for Boring Logs

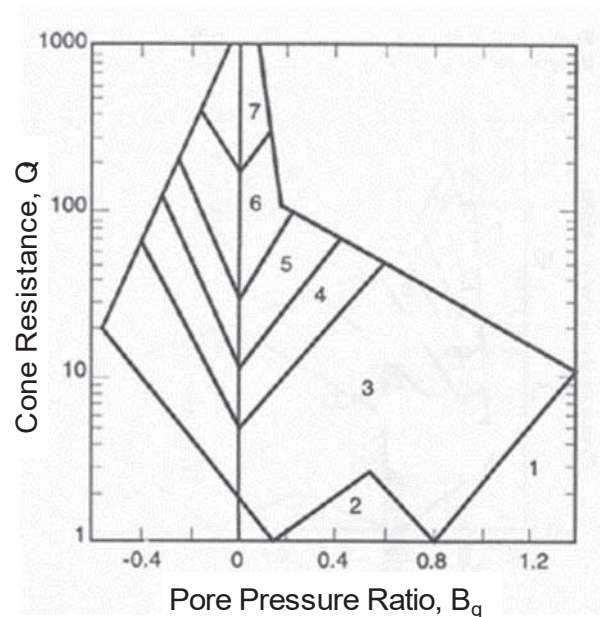
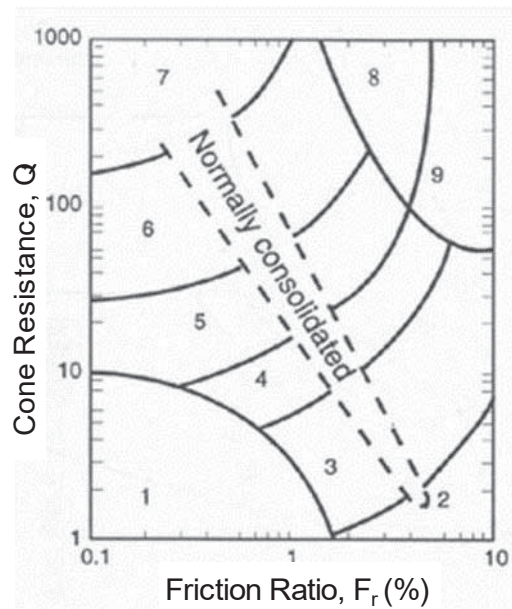
Hand Auger Boring Logs (K-1 through K-7)

Kessler DCP Test Data (K-1 through K-7)



## REFERENCE NOTES FOR CONE PENETRATION TEST (CPT) SOUNDINGS

In the CPT sounding procedure (ASTM-D-5778), an electronically instrumented cone penetrometer is hydraulically advanced through soil to measure point resistance ( $q_c$ ), pore water pressure ( $u_2$ ), and sleeve friction ( $f_s$ ). These values are recorded continuously as the cone is pushed to the desired depth. CPT data is corrected for depth and used to estimate soil classifications and intrinsic soil parameters such as angle of internal friction, preconsolidation pressure, and undrained shear strength. The graphs below represent one of the accepted methods of CPT soil behavior classification (Robertson, 1990).



1. Sensitive, Fine Grained
2. Organic Soils-Peats
3. Clays; Clay to Silty Clay
4. Clayey Silt to Silty Clay
5. Silty Sand to Sandy Silt

6. Clean Sands to Silty Sands
7. Gravelly Sand to Sand
8. Very Stiff Sand to Clayey Sand
9. Very Stiff Fine Grained

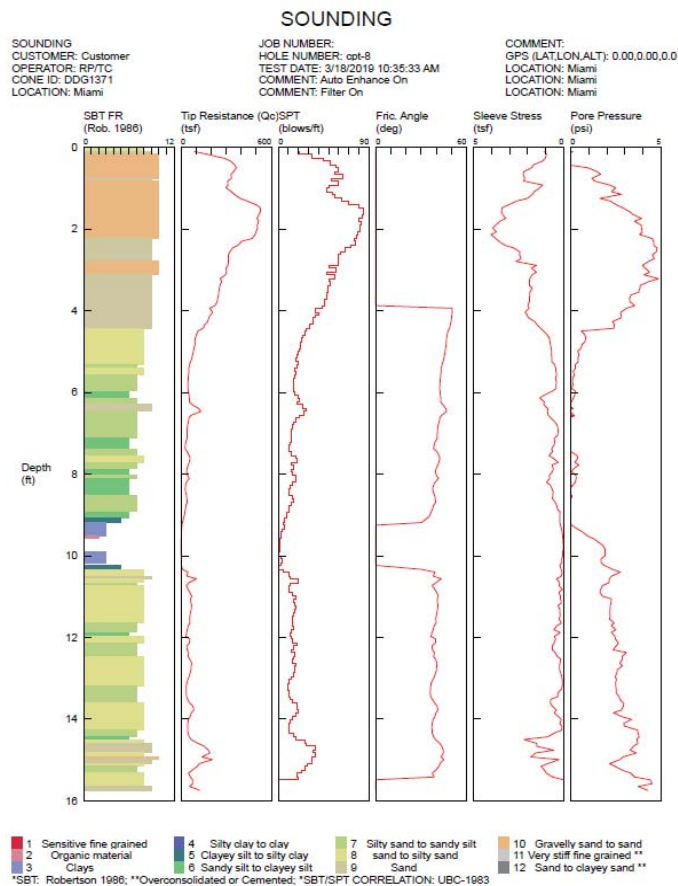
The following table presents a correlation of corrected cone tip resistance ( $q_t$ ) to soil consistency or relative density:

SAND		SILT/CLAY	
Corrected Cone Tip Resistance ( $q_t$ ) (tsf)	Relative Density	Corrected Cone Tip Resistance ( $q_t$ ) (tsf)	Relative Density
<20	Very Loose	<5	Very Soft
20-40	Loose	5-10	Soft
40-120	Medium Dense	10-15	Firm
		15-30	Stiff
120-200	Dense	30-45	Very Stiff
		45-60	Hard
>200	Very Dense	>60	Very Hard



## SUBSURFACE EXPLORATION PROCEDURE: CONE PENETRATION TESTING (CPT) ASTM D 5778

In the CPT sounding procedure, an electronically instrumented cone penetrometer is hydraulically advanced through soil to measure point resistance ( $q_c$ ), pore water pressure ( $U_2$ ), and sleeve friction ( $f_s$ ). These values are recorded continuously as the cone is pushed to the desired depth. CPT data is corrected for depth and used to estimate soil classifications and intrinsic soil parameters such as angle of internal friction, pre-consolidation pressure, and undrained shear strength.



### CPT Procedure:

- Involves the direct push of an electronically instrumented cone penetrometer\* through the soil
- Values are recorded continuously
- CPT data is corrected and correlated to soil parameters

\*CPT Penetrometer Size May Vary

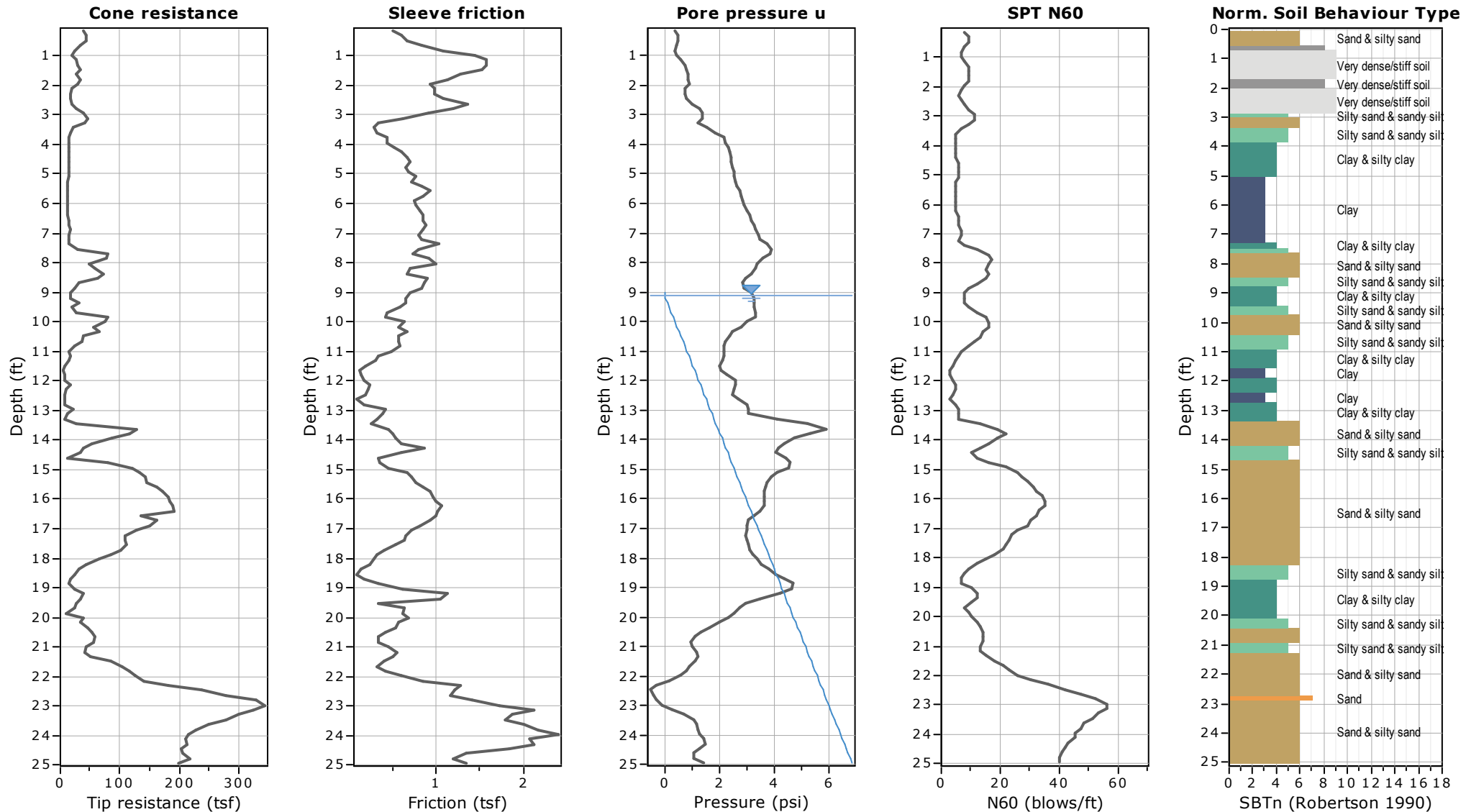


ECS Southeast, LLP  
6714 Netherlands Drive  
Wilmington, NC 28403  
ECS Project # 22-33895

Project: BCC - Public Safety Building  
Location: Bolivia, Brunswick County, North Carolina

CPT: S-1

Total depth: 24.93 ft, Date: 10/31/2023  
Cone Operator: Cory Robison



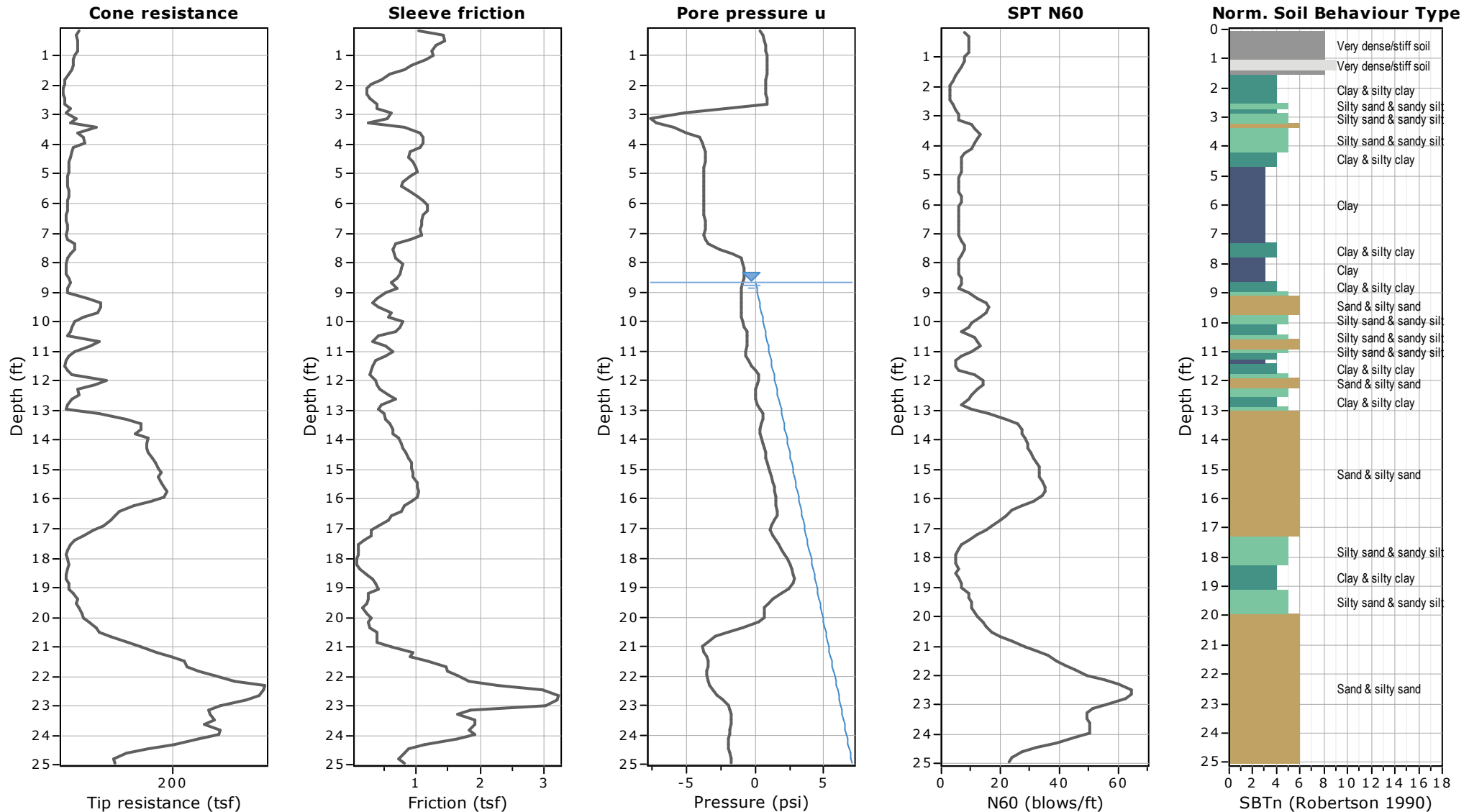


**ECS Southeast, LLP**  
6714 Netherlands Drive  
Wilmington, NC 28403  
ECS Project # 22-33895

**Project:** BCC - Public Safety Building  
**Location:** Bolivia, Brunswick County, North Carolina

**CPT: S-2**

Total depth: 24.93 ft, Date: 10/31/2023  
Cone Operator: Cory Robison





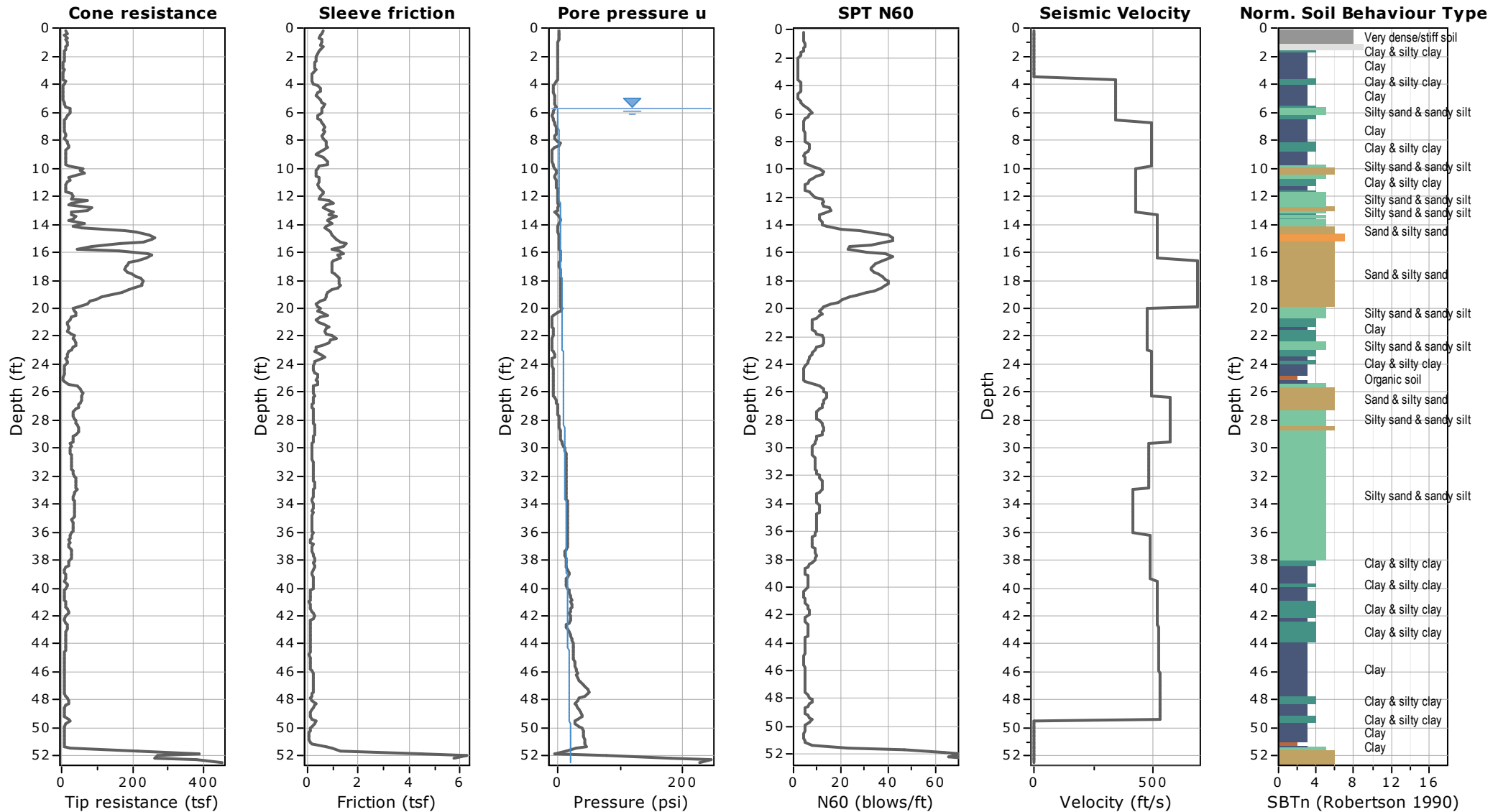


ECS Southeast, LLP  
6714 Netherlands Drive  
Wilmington, NC 28403  
ECS Project # 22-33895

Project: BCC - Public Safety Building  
Location: Bolivia, Brunswick County, North Carolina

CPT: S-3

Total depth: 52.49 ft, Date: 10/31/2023  
Cone Operator: Cory Robison



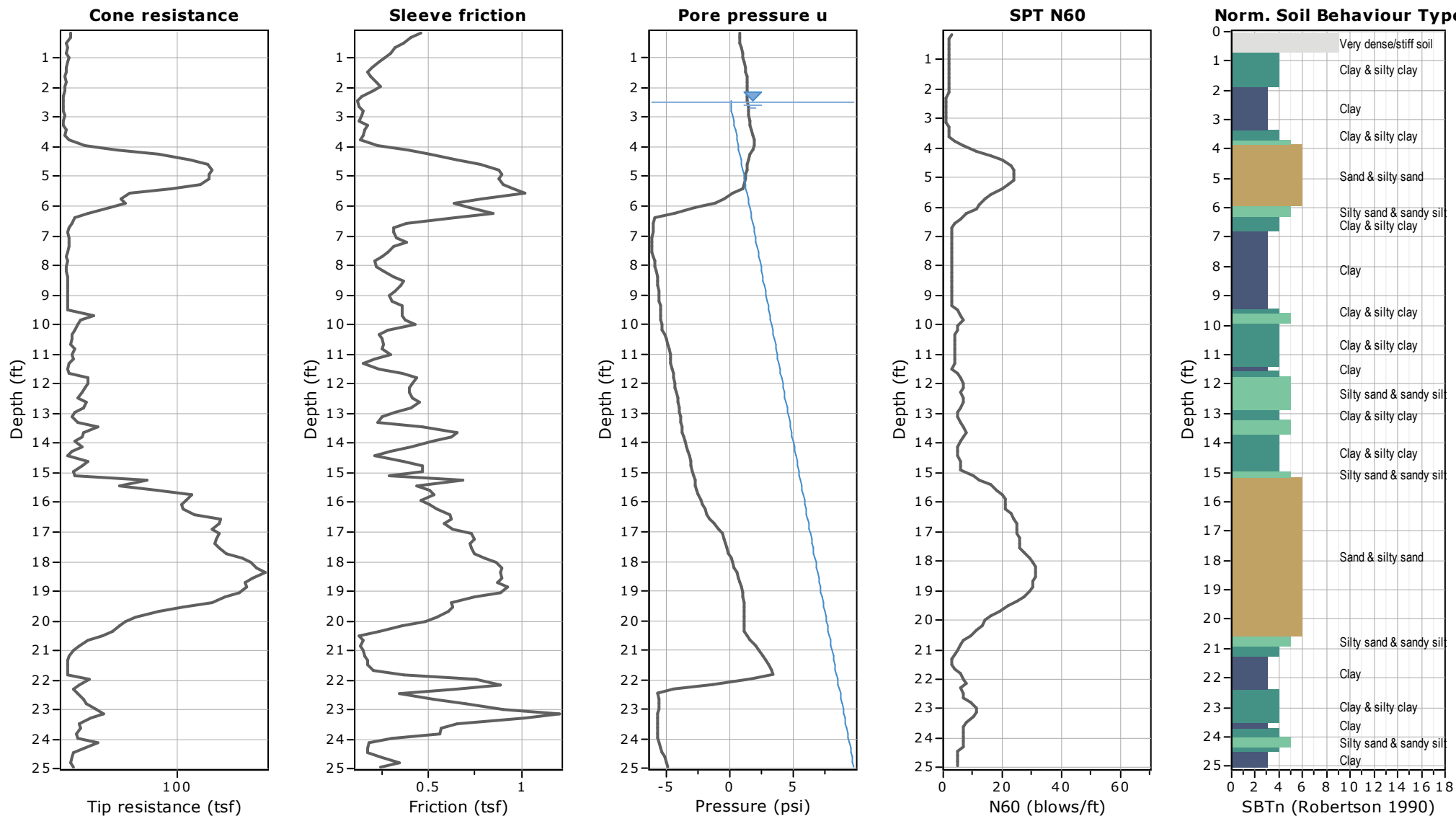


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6714 Netherlands Drive  
Wilmington, NC 28403  
ECS Project # 22-33895

**Project:** BCC - Public Safety Building  
**Location:** Bolivia, Brunswick County, North Carolina

**CPT: S-4**

Total depth: 24.93 ft, Date: 10/31/2023  
Cone Operator: Cory Robison



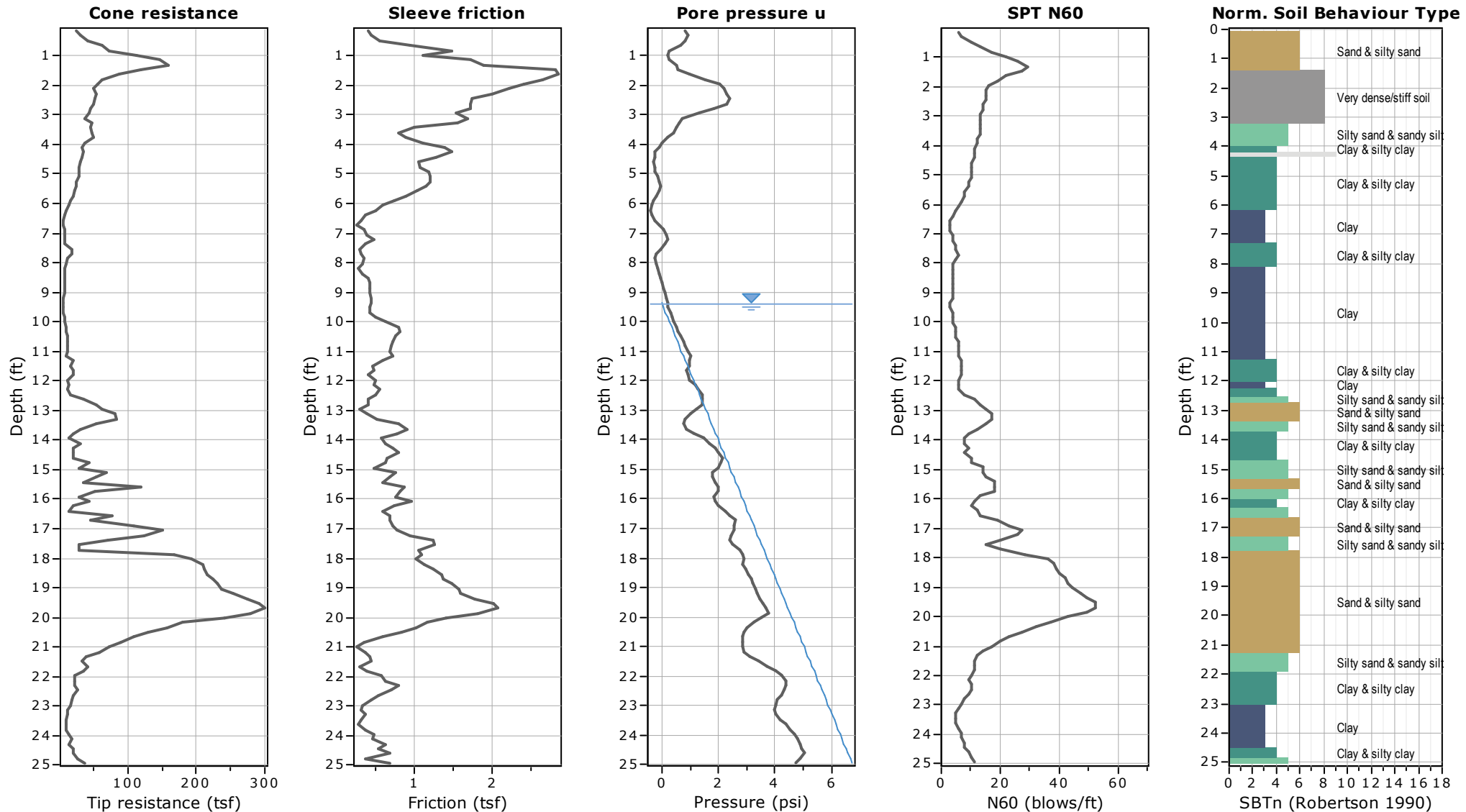


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6714 Netherlands Drive  
Wilmington, NC 28403  
ECS Project # 22-33895

Project: BCC - Public Safety Building  
Location: Bolivia, Brunswick County, North Carolina

CPT: S-5

Total depth: 24.93 ft, Date: 10/31/2023  
Cone Operator: Cory Robison



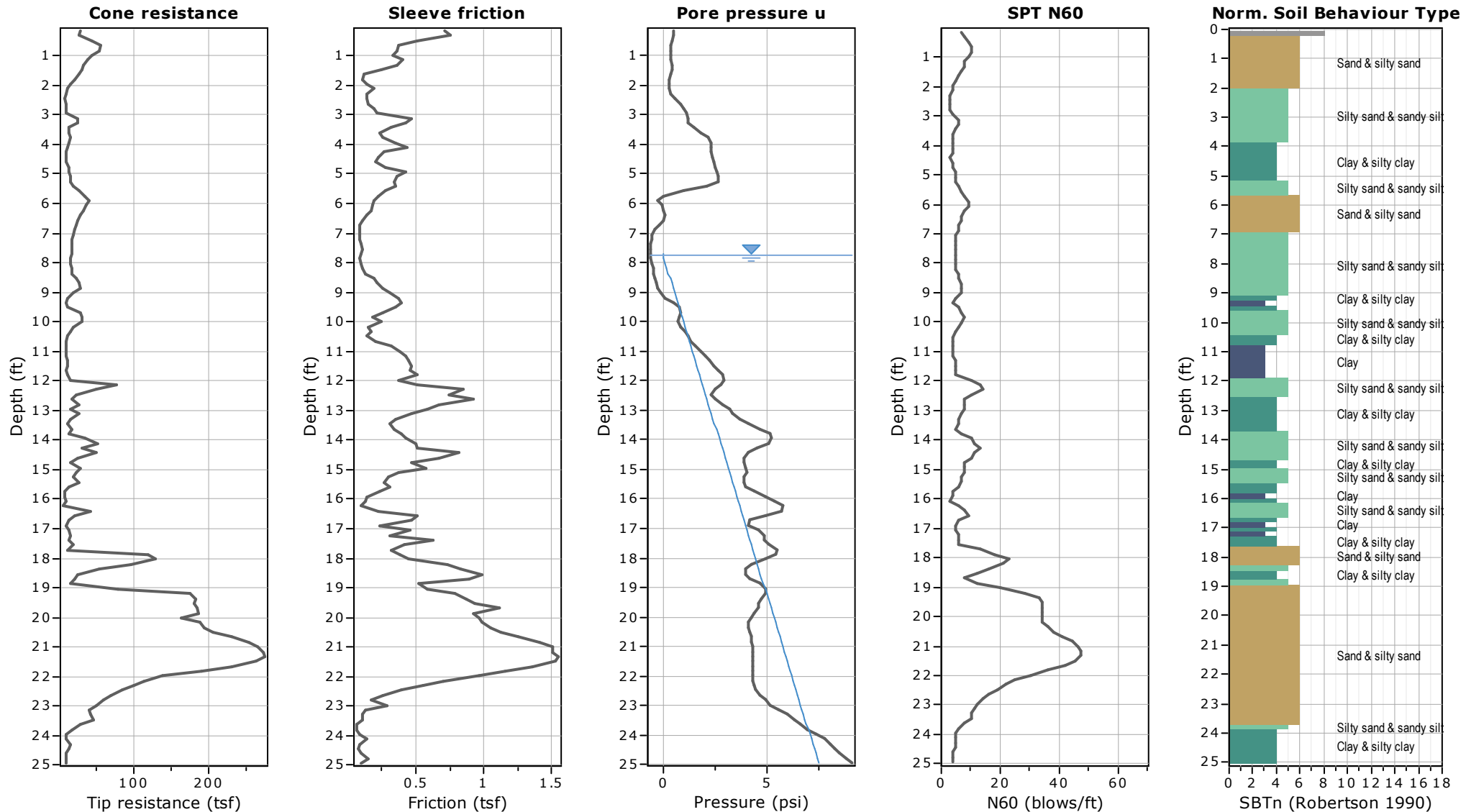


ECS Southeast, LLP  
6714 Netherlands Drive  
Wilmington, NC 28403  
ECS Project # 22-33895

Project: BCC - Public Safety Building  
Location: Bolivia, Brunswick County, North Carolina

CPT: S-6

Total depth: 24.93 ft, Date: 10/31/2023  
Cone Operator: Cory Robison





# REFERENCE NOTES FOR BORING LOGS

## MATERIAL<sup>1,2</sup>

	<b>ASPHALT</b>
	<b>CONCRETE</b>
	<b>GRAVEL</b>
	<b>TOPSOIL</b>
	<b>VOID</b>
	<b>BRICK</b>
	<b>AGGREGATE BASE COURSE</b>
	<b>GW WELL-GRADED GRAVEL</b> gravel-sand mixtures, little or no fines
	<b>GP POORLY-GRADED GRAVEL</b> gravel-sand mixtures, little or no fines
	<b>GM SILTY GRAVEL</b> gravel-sand-silt mixtures
	<b>GC CLAYEY GRAVEL</b> gravel-sand-clay mixtures
	<b>SW WELL-GRADED SAND</b> gravelly sand, little or no fines
	<b>SP POORLY-GRADED SAND</b> gravelly sand, little or no fines
	<b>SM SILTY SAND</b> sand-silt mixtures
	<b>SC CLAYEY SAND</b> sand-clay mixtures
	<b>ML SILT</b> non-plastic to medium plasticity
	<b>MH ELASTIC SILT</b> high plasticity
	<b>CL LEAN CLAY</b> low to medium plasticity
	<b>CH FAT CLAY</b> high plasticity
	<b>OL ORGANIC SILT or CLAY</b> non-plastic to low plasticity
	<b>OH ORGANIC SILT or CLAY</b> high plasticity
	<b>PT PEAT</b> highly organic soils

## DRILLING SAMPLING SYMBOLS & ABBREVIATIONS

SS	Split Spoon Sampler	PM	Pressuremeter Test
ST	Shelby Tube Sampler	RD	Rock Bit Drilling
WS	Wash Sample	RC	Rock Core, NX, BX, AX
BS	Bulk Sample of Cuttings	REC	Rock Sample Recovery %
PA	Power Auger (no sample)	RQD	Rock Quality Designation %
HSA	Hollow Stem Auger		

## PARTICLE SIZE IDENTIFICATION

DESIGNATION	PARTICLE SIZES
Boulders	12 inches (300 mm) or larger
Cobbles	3 inches to 12 inches (75 mm to 300 mm)
Gravel: Coarse	¾ inch to 3 inches (19 mm to 75 mm)
Fine	4.75 mm to 19 mm (No. 4 sieve to ¾ inch)
Sand: Coarse	2.00 mm to 4.75 mm (No. 10 to No. 4 sieve)
Medium	0.425 mm to 2.00 mm (No. 40 to No. 10 sieve)
Fine	0.074 mm to 0.425 mm (No. 200 to No. 40 sieve)
Silt & Clay ("Fines")	<0.074 mm (smaller than a No. 200 sieve)

## COHESIVE SILTS & CLAYS

UNCONFINED COMPRESSIVE STRENGTH, QP <sup>4</sup>	SPT <sup>5</sup> (BPF)	CONSISTENCY <sup>7</sup> (COHESIVE)
<0.25	<2	Very Soft
0.25 - <0.50	2 - 4	Soft
0.50 - <1.00	5 - 8	Firm
1.00 - <2.00	9 - 15	Stiff
2.00 - <4.00	16 - 30	Very Stiff
4.00 - 8.00	31 - 50	Hard
>8.00	>50	Very Hard

RELATIVE AMOUNT <sup>7</sup>	COARSE GRAINED (%) <sup>8</sup>	FINE GRAINED (%) <sup>8</sup>
Trace	≤5	≤5
With	10 - 20	10 - 25
Adjective (ex: "Silty")	25 - 45	30 - 45

## GRAVELS, SANDS & NON-COHESIVE SILTS

SPT <sup>5</sup>	DENSITY
<5	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
>50	Very Dense

## WATER LEVELS<sup>6</sup>

	WL (First Encountered)
	WL (Completion)
	WL (Seasonal High Water)
	WL (Stabilized)

## FILL AND ROCK

<b>FILL</b>	<b>POSSIBLE FILL</b>	<b>PROBABLE FILL</b>	<b>ROCK</b>

<sup>1</sup>Classifications and symbols per ASTM D 2488-17 (Visual-Manual Procedure) unless noted otherwise.

<sup>2</sup>To be consistent with general practice, "POORLY GRADED" has been removed from GP, GP-GM, GP-GC, SP, SP-SM, SP-SC soil types on the boring logs.

<sup>3</sup>Non-ASTM designations are included in soil descriptions and symbols along with ASTM symbol [Ex: (SM-FILL)].


<sup>4</sup>Typically estimated via pocket penetrometer or Torvane shear test and expressed in tons per square foot (tsf).

<sup>5</sup>Standard Penetration Test (SPT) refers to the number of hammer blows (blow count) of a 140 lb. hammer falling 30 inches on a 2 inch OD split spoon sampler required to drive the sampler 12 inches (ASTM D 1586). "N-value" is another term for "blow count" and is expressed in blows per foot (bpf). SPT correlations per 7.4.2 Method B and need to be corrected if using an auto hammer.

<sup>6</sup>The water levels are those levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in granular soils. In clay and cohesive silts, the determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally employed.

<sup>7</sup>Minor deviation from ASTM D 2488-17 Note 14.

<sup>8</sup>Percentages are estimated to the nearest 5% per ASTM D 2488-17.

CLIENT: <b>Brunswick Community College</b>	PROJECT NO.: <b>22:33895</b>	SHEET: <b>1 of 1</b>	
PROJECT NAME: <b>BCC - Public Safety Building</b>	HAND AUGER NO.: <b>K-01</b>	SURFACE ELEVATION:	
SITE LOCATION: <b>50 College Rd NE, Bolivia, North Carolina, 28422</b>		STATION:	
NORTHING:	EASTING:		

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	SAMPLE NUMBER	FINES CONTENT (%)	MOISTURE CONTENT (%)
			(SC) CLAYEY SAND, gray, moist					
			(CL) SANDY LEAN CLAY, gray/ tan, moist					
			END OF HAND AUGER AT 4 FT					
5		-5						

REMARKS:							
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL							
EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT							
<input type="checkbox"/> WL (First Encountered)	<input checked="" type="checkbox"/> WL (Seasonal High)	ECS REP:	DATE COMPLETED:	UNITS:	CAVE-IN-DEPTH:		
<input checked="" type="checkbox"/> WL (Completion)			Oct 26 2023	English			
<b>HAND AUGER LOG</b>							

## DCP TEST DATA

**Project:** *BCC - Public Safety Building*

Date: 26-Oct-23

**Location:** K-1

Soil Type(s): SAND (SC), CLAY (CL)

Hammer \_\_\_\_\_

☐ 10.1 lbs.

☒ 17.6 lbs.

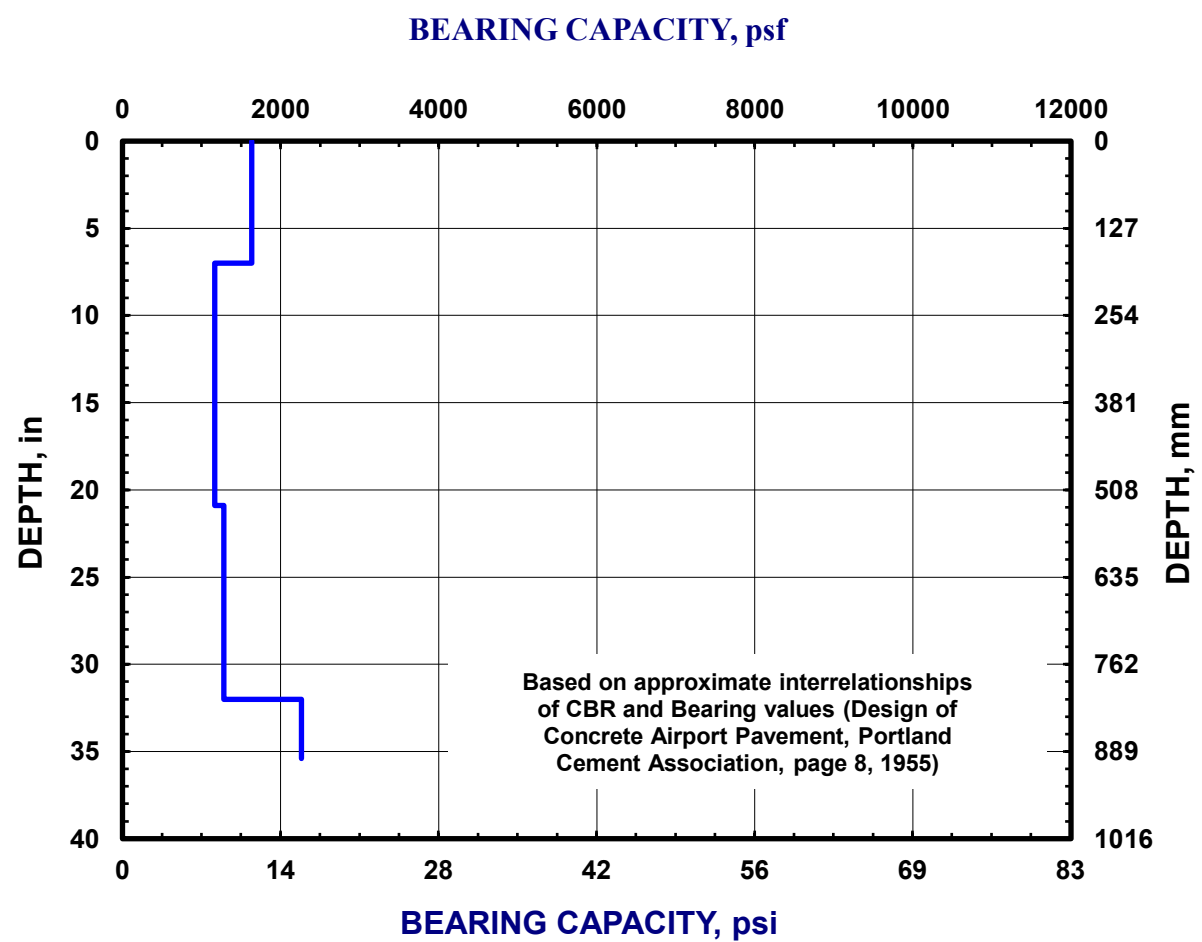
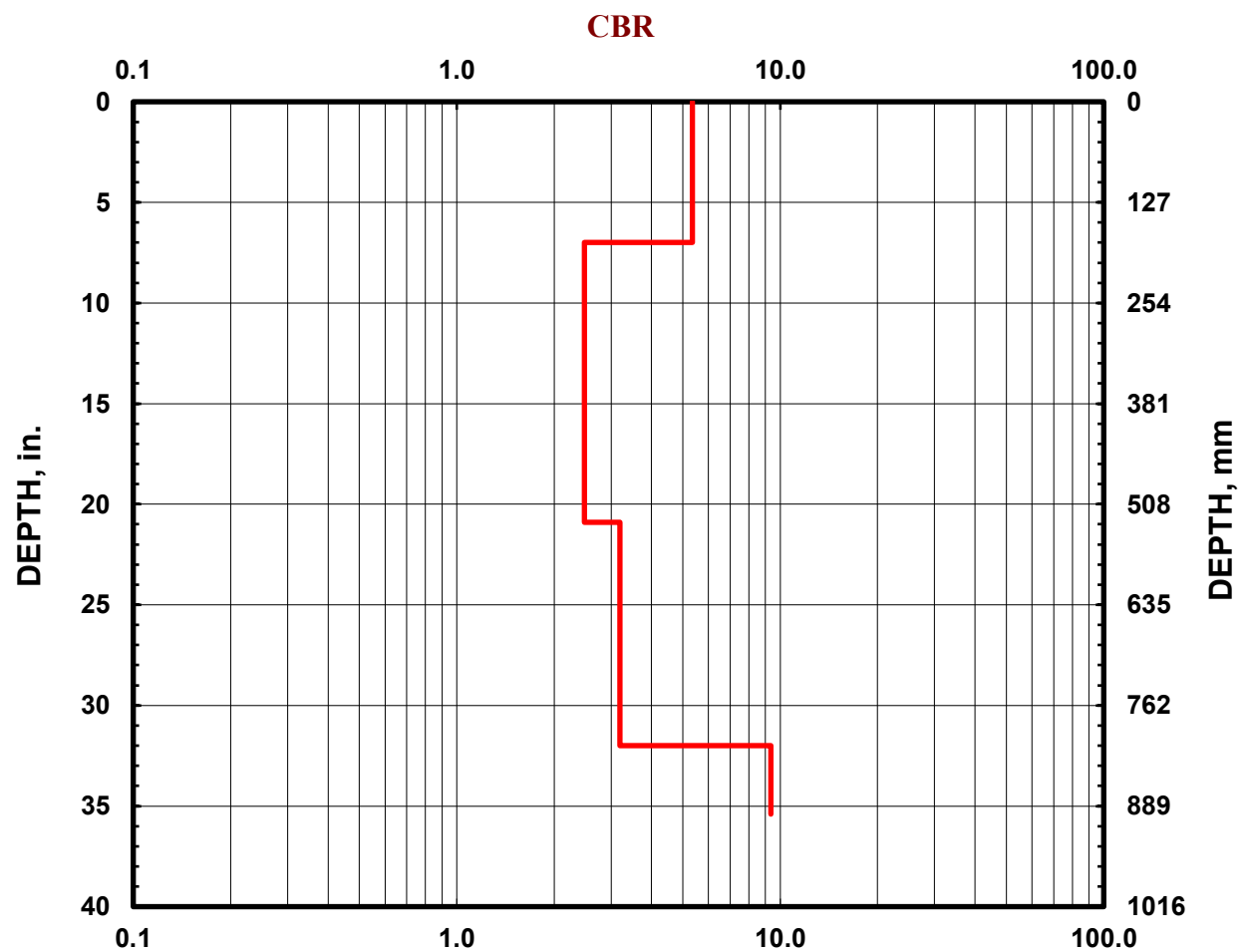
☐ Both hammers used


Soil Type \_\_\_\_\_

☐ CH

☐ CL

☒ All other soils

[illegible]

CLIENT: <b>Brunswick Community College</b>	PROJECT NO.: <b>22:33895</b>	SHEET: <b>1 of 1</b>	
PROJECT NAME: <b>BCC - Public Safety Building</b>	HAND AUGER NO.: <b>K-02</b>	SURFACE ELEVATION:	
SITE LOCATION: <b>50 College Rd NE, Bolivia, North Carolina, 28422</b>		STATION:	
NORTHING:		EASTING:	

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	SAMPLE NUMBER	FINES CONTENT (%)	MOISTURE CONTENT (%)
			(SM) SILTY FINE SAND, brown, moist, contains roots					
			(SC) CLAYEY FINE SAND, tan/ gray, moist					
			(CL) SANDY LEAN CLAY, tan/ gray, moist					
			(SM) SILTY FINE SAND, dark brown, moist					
			END OF HAND AUGER AT 4 FT					
5		-5						

REMARKS:							
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL							
EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT							
<input type="checkbox"/> WL (First Encountered)		<input checked="" type="checkbox"/> WL (Seasonal High)		ECS REP:	DATE COMPLETED:	UNITS:	CAVE-IN-DEPTH:
<input checked="" type="checkbox"/> WL (Completion)					Oct 26 2023	English	
<b>HAND AUGER LOG</b>							



## DCP TEST DATA

**Project:** *BCC - Public Safety Building*

**Location:** K-2

**Date:** 26-Oct-23

**Soil Type(s): SAND (SC, SM), CLAY (CL)**

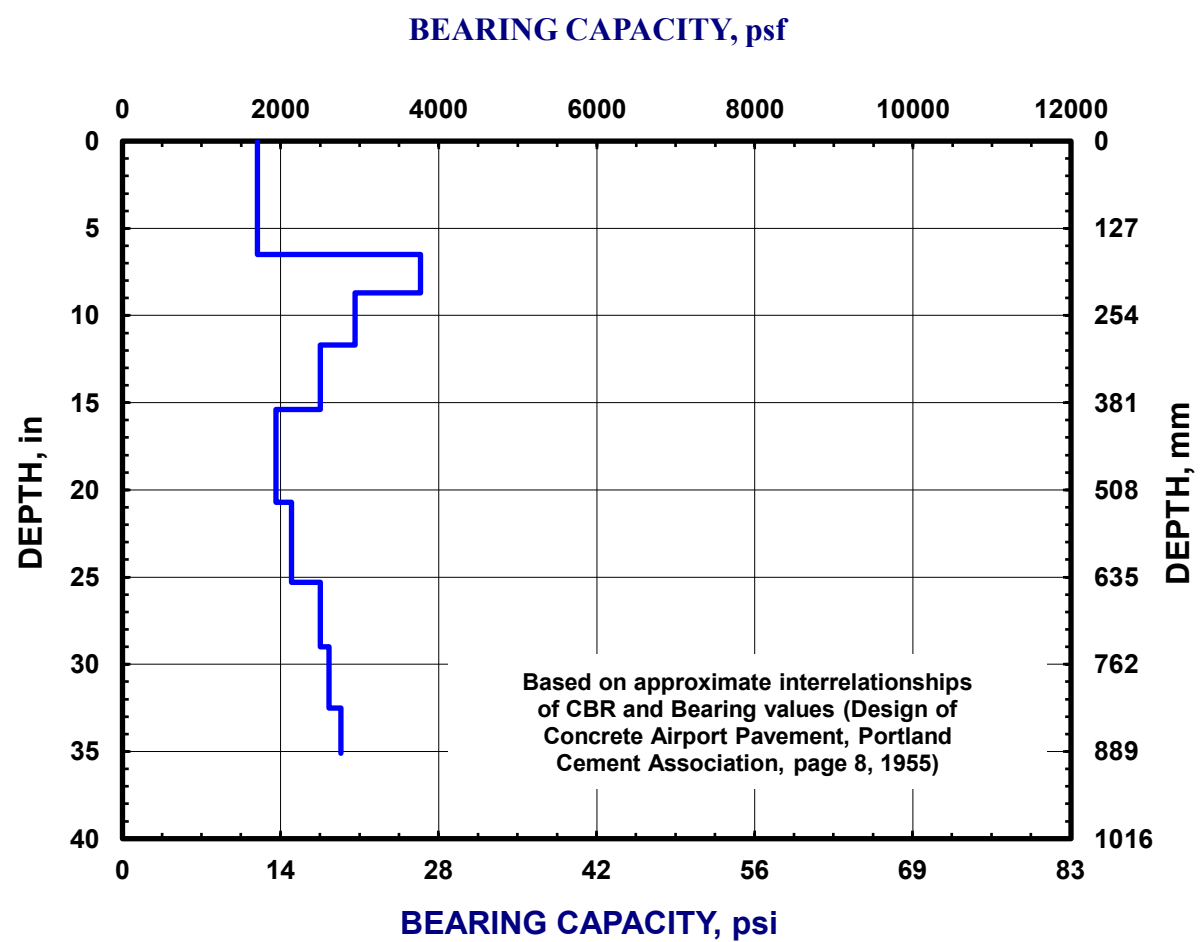
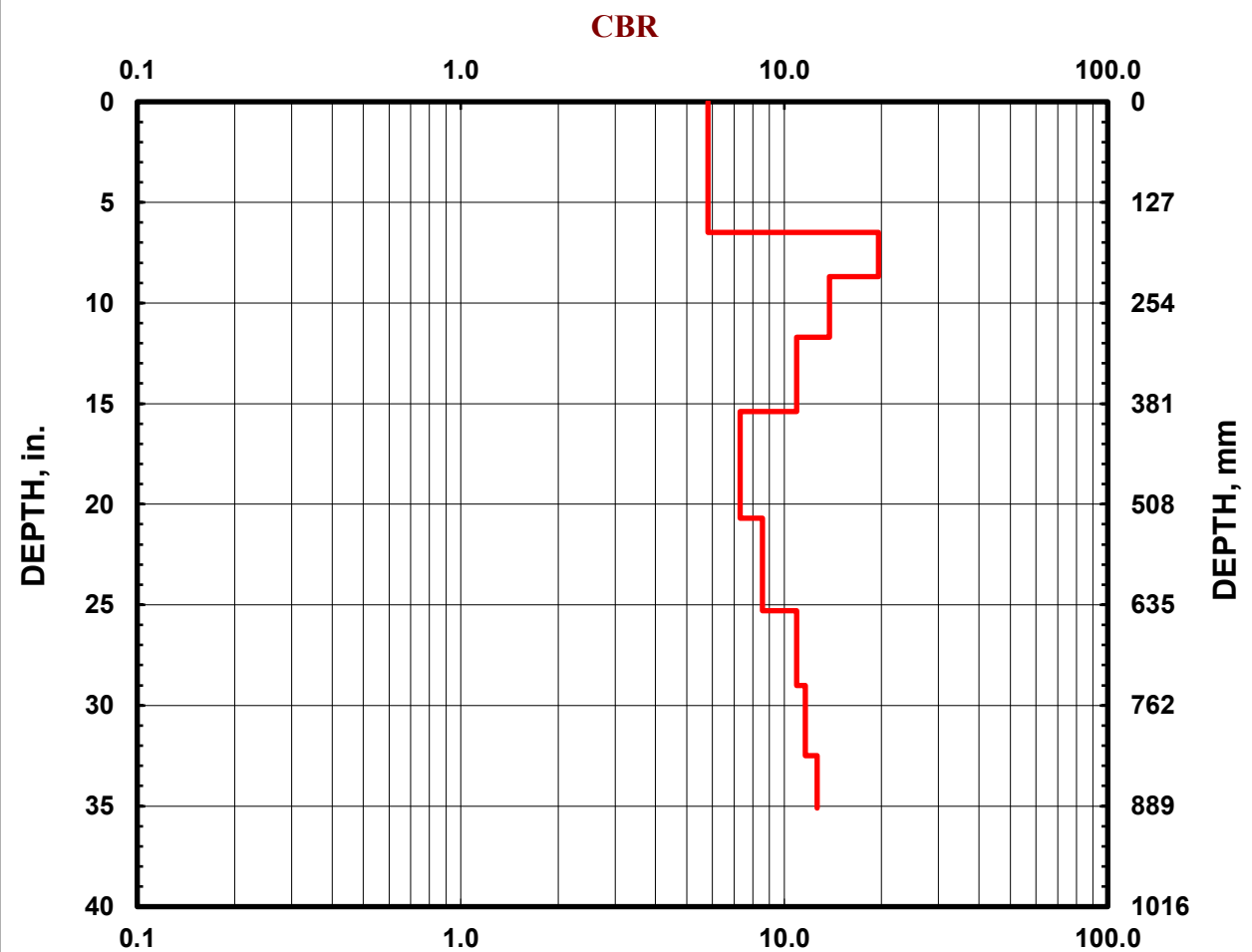
Hammer \_\_\_\_\_  
☐ 10.1 lbs.  
☒ 17.6 lbs.  
☐ Both hammers used


Soil Type

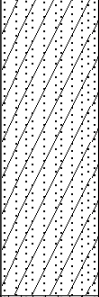
☐ CH

☐ CL

☒ All other soils

[illegible]

CLIENT: <b>Brunswick Community College</b>			PROJECT NO.: <b>22:33895</b>		SHEET: <b>1 of 1</b>				
PROJECT NAME: <b>BCC - Public Safety Building</b>			HAND AUGER NO.: <b>K-03</b>		SURFACE ELEVATION:				
SITE LOCATION: <b>50 College Rd NE, Bolivia, North Carolina, 28422</b>					STATION:				
NORTHING:			EASTING:						

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	SAMPLE NUMBER	FINES CONTENT (%)	MOISTURE CONTENT (%)
			(SC) CLAYEY SAND, gray/ brown, moist, contains roots					
			(SM) SILTY FINE SAND, gray, moist					
			(OL/OH) ORGANIC SOIL, dark brown/ black, moist					
			(CL) SANDY LEAN CLAY, gray, moist to wet					
			END OF HAND AUGER AT 4 FT					
5		-5						

REMARKS:

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

<input type="checkbox"/> WL (First Encountered)	<input checked="" type="checkbox"/> WL (Seasonal High)	ECS REP:	DATE COMPLETED:	UNITS:	CAVE-IN-DEPTH:
<input checked="" type="checkbox"/> WL (Completion)			Oct 26 2023	English	

HAND AUGER LOG

## DCP TEST DATA

**Project:** *BCC - Public Safety Building*

Location: K-3

**Date:** 26-Oct-23

**Soil Type(s):** SAND (SC, SM), CLAY (CL), ORGANIC (OL/OH)

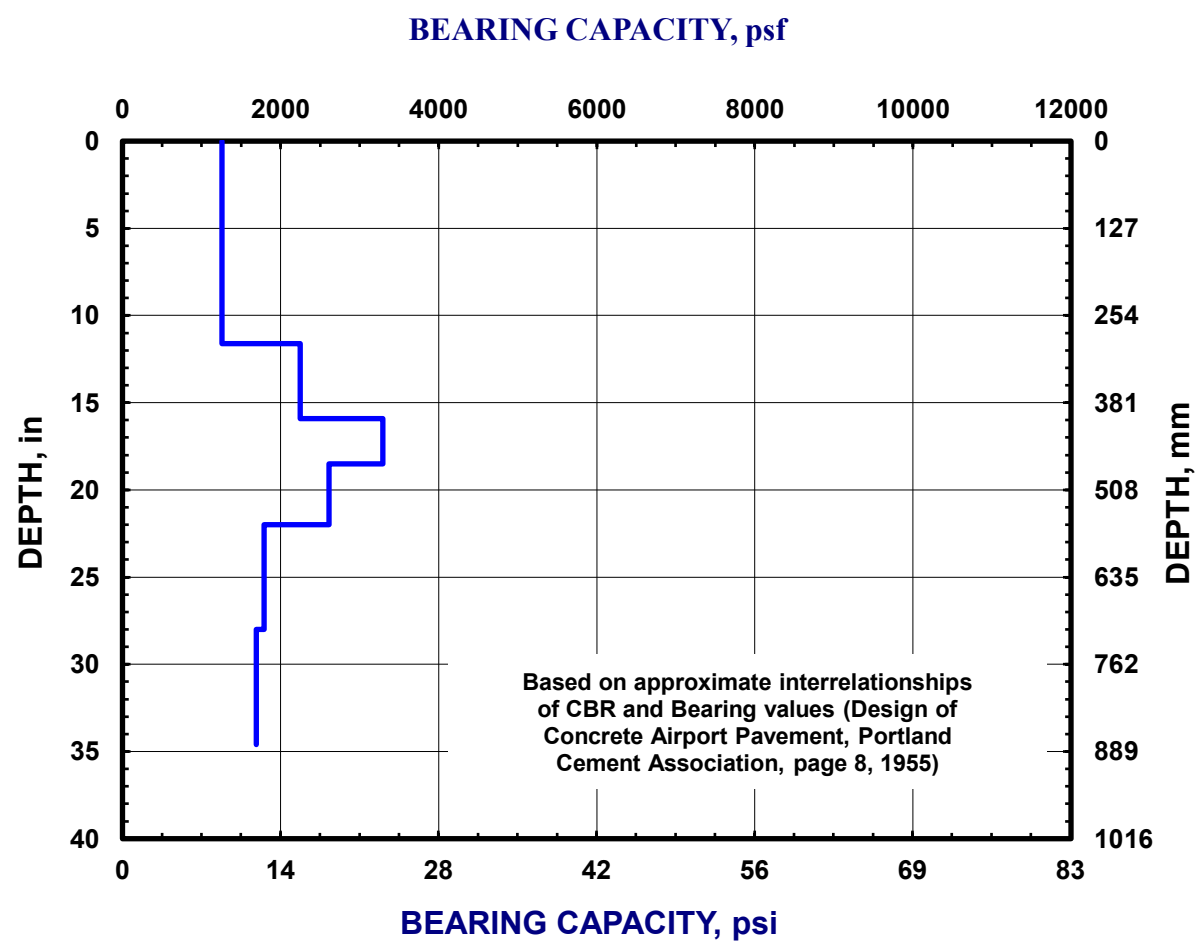
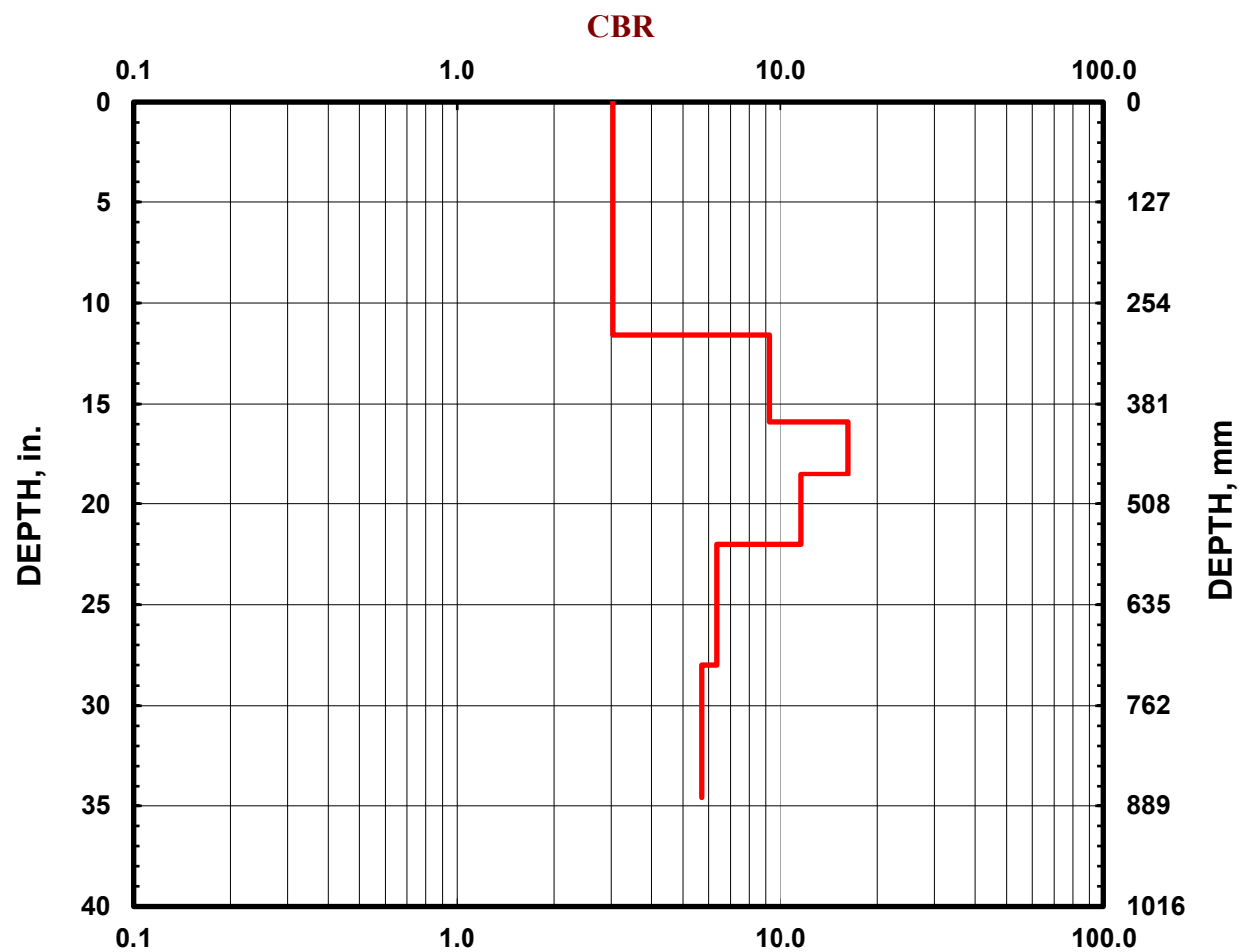
Hammer \_\_\_\_\_  
☐ 10.1 lbs.  
☒ 17.6 lbs.  
☐ Both hammers used


Soil Type \_\_\_\_\_

☐ CH

☐ CL

☒ All other soils

[illegible]

CLIENT: <b>Brunswick Community College</b>	PROJECT NO.: <b>22:33895</b>	SHEET: <b>1 of 1</b>	
PROJECT NAME: <b>BCC - Public Safety Building</b>	HAND AUGER NO.: <b>K-04</b>	SURFACE ELEVATION:	
SITE LOCATION: <b>50 College Rd NE, Bolivia, North Carolina, 28422</b>		STATION:	
NORTHING:		EASTING:	

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	SAMPLE NUMBER	FINES CONTENT (%)	MOISTURE CONTENT (%)
			Topsoil Thickness[6.00"]					
			(CL) SANDY LEAN CLAY, gray/ tan, moist					
			(SC) CLAYEY SAND, tan, moist					
			END OF HAND AUGER AT 4 FT					
5		-5						

REMARKS:							
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL							
EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT							
<input type="checkbox"/> WL (First Encountered)	<input checked="" type="checkbox"/> WL (Seasonal High)	ECS REP:	DATE COMPLETED:	UNITS:	CAVE-IN-DEPTH:		
<input checked="" type="checkbox"/> WL (Completion)			Oct 26 2023	English			
<b>HAND AUGER LOG</b>							

## DCP TEST DATA

**Project:** *BCC - Public Safety Building*

Location: K-4

**Date:** 26-Oct-23

Soil Type(s): SAND (SC), CLAY (CL)

Hammer \_\_\_\_\_

☐ 10.1 lbs.

☒ 17.6 lbs.

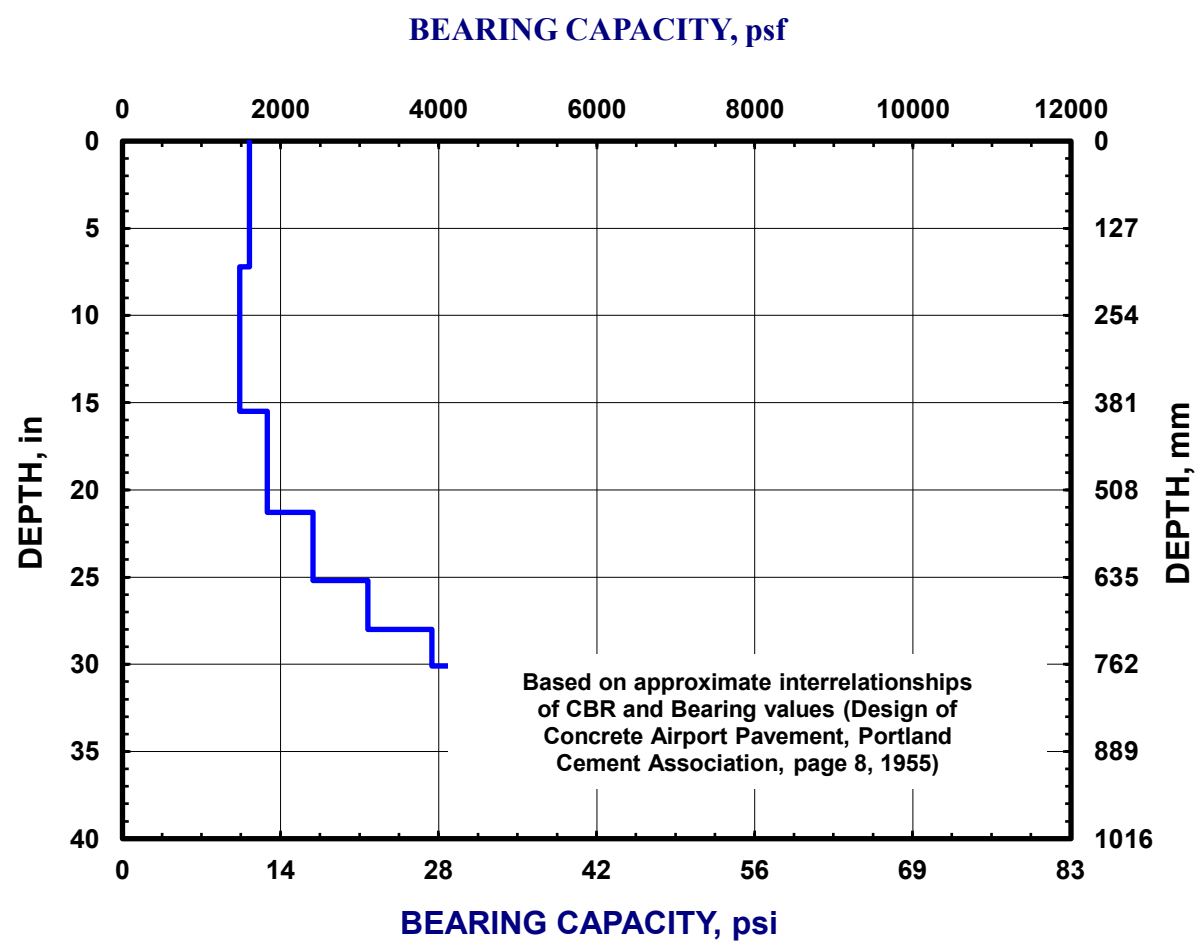
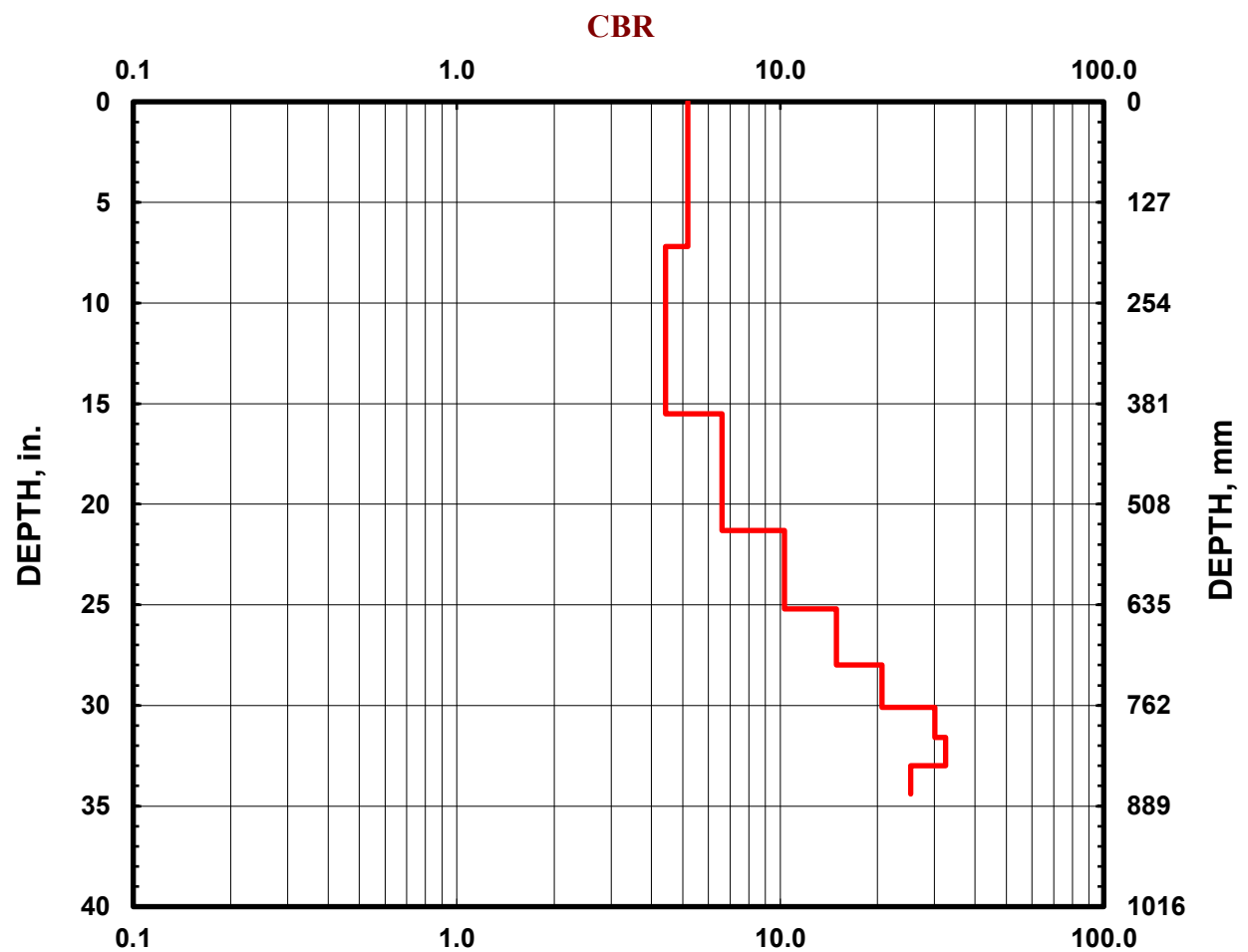
☐ Both hammers used



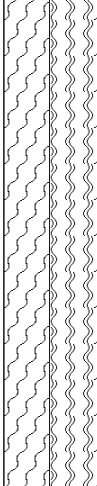

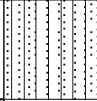
Soil Type \_\_\_\_\_

☐ CH

☐ CL

☒ All other soils

[illegible]

CLIENT: <b>Brunswick Community College</b>		PROJECT NO.: <b>22:33895</b>		SHEET: <b>1 of 1</b>				
PROJECT NAME: <b>BCC - Public Safety Building</b>		HAND AUGER NO.: <b>K-05</b>		SURFACE ELEVATION:				
SITE LOCATION: <b>50 College Rd NE, Bolivia, North Carolina, 28422</b>				STATION:				
NORTHING:		EASTING:						
DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	SAMPLE NUMBER	FINES CONTENT (%)	MOISTURE CONTENT (%)
			Topsoil Thickness[3.00"]					
			(OL/OH) ORGANIC SOIL, dark brown/ black, moist					
			(CL) SANDY LEAN CLAY, gray, moist					
			(SM) SILTY FINE SAND, gray, moist					
			END OF HAND AUGER AT 4 FT					
5		-5						
REMARKS:								
THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL								
EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT								
<input type="checkbox"/> WL (First Encountered)		<input checked="" type="checkbox"/> WL (Seasonal High)		ECS REP:	DATE COMPLETED:	UNITS:	CAVE-IN-DEPTH:	
<input checked="" type="checkbox"/> WL (Completion)					Oct 26 2023	English		
HAND AUGER LOG								

## DCP TEST DATA

**Project:** *BCC - Public Safety Building*

Location: K-5

**Date:** 26-Oct-23

**Soil Type(s):** SAND (SM), CLAY (CL), ORGANIC (OL/OH)

Hammer \_\_\_\_\_

☐ 10.1 lbs.

☒ 17.6 lbs.

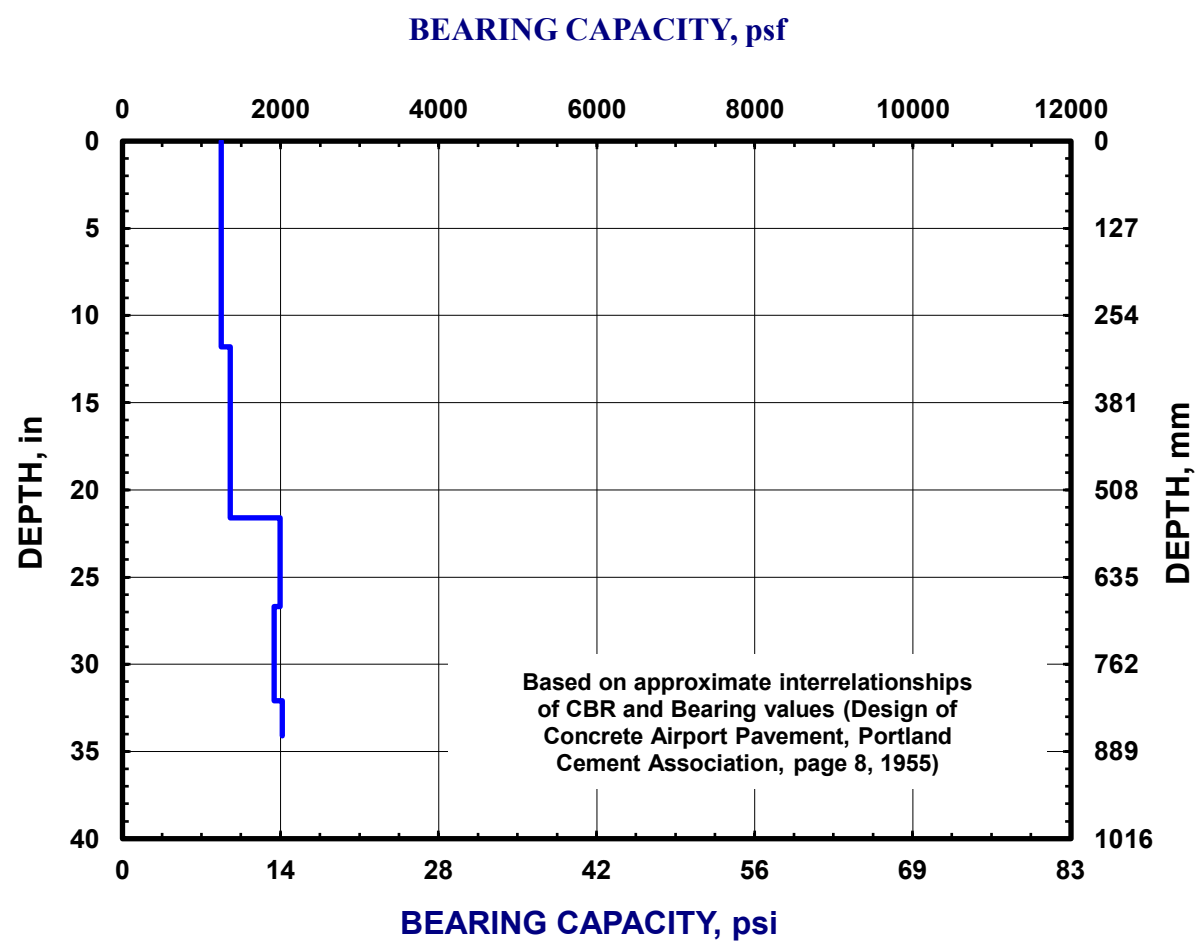
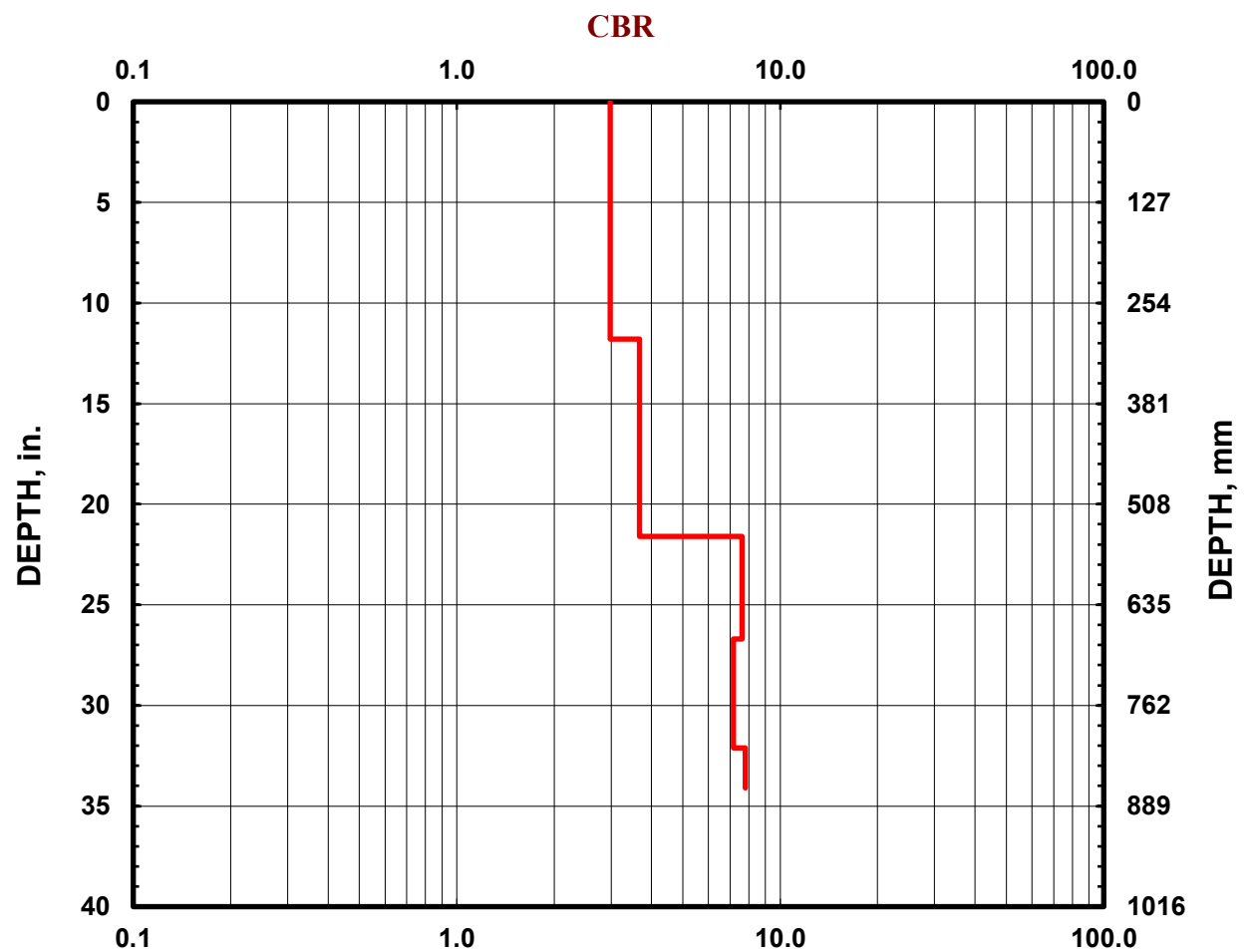
☐ Both hammers used

Soil Type \_\_\_\_\_

☐ CH

☐ CL

☒ All other soils

[illegible]

## **APPENDIX C – Supplemental Report Documents**

GBA Document



# Important Information about This Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

**The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.**

## **Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects**

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled.* No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

## **Read this Report in Full**

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

## **You Need to Inform Your Geotechnical Engineer about Change**

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

## **This Report May Not Be Reliable**

*Do not rely on this report* if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be, and, in general, if you are the least bit uncertain about the continued reliability of this report, contact your geotechnical engineer before applying it.* A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

## **Most of the "Findings" Related in This Report Are Professional Opinions**

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

## This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

## This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

## Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may

perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

## Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

## Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old*.

## Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, *proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration*. Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. *Geotechnical engineers are not building-envelope or mold specialists*.



Telephone: 301/565-2733

e-mail: [info@geoprofessional.org](mailto:info@geoprofessional.org) [www.geoprofessional.org](http://www.geoprofessional.org)

# FORM OF PROPOSAL

Project: Brunswick Community College Alan Holden Public Safety Center

Contract: Single Prime

Institution: The Trustees of Brunswick Community College Bidder: \_\_\_\_\_

SCO-ID #: 22-25751-02A

Date: \_\_\_\_\_

The undersigned, as bidder, hereby declares that the only person or persons interested in this proposal as principal or principals is or are named herein and that no other person than herein mentioned has any interest in this proposal or in the contract to be entered into; that this proposal is made without connection with any other person, company or parties making a bid or proposal; and that it is in all respects fair and in good faith without collusion or fraud. The bidder further declares that he has examined the site of the work and the contract documents relative thereto, and has read all special provisions furnished prior to the opening of bids; that he has satisfied himself relative to the work to be performed. The bidder further declares that he and his subcontractors have fully complied with NCGS 64, Article 2 in regards to E-Verification as required by Section 2.(c) of Session Law 2013-418, codified as N.C. Gen. Stat. § 143-129(j).

The Bidder proposes and agrees if this proposal is accepted to contract with the

The Trustees of Brunswick Community College

in the form of contract specified below, to furnish all necessary materials, equipment, machinery, tools, apparatus, means of transportation and labor necessary to complete the construction of

Brunswick Community College Alan Holden Public Safety Center

in full in complete accordance with the plans, specifications and contract documents, to the full and entire satisfaction of the State of North Carolina, and the

Brunswick Community College and Sawyer Sherwood & Associate, P.C.

with a definite understanding that no money will be allowed for extra work except as set forth in the General Conditions and the contract documents, for the sum of:

## SINGLE PRIME CONTRACT:

Base Bid:

\_\_\_\_\_ Dollars(\$)

General Subcontractor:

\_\_\_\_\_ Lic \_\_\_\_\_

Plumbing Subcontractor:

\_\_\_\_\_ Lic \_\_\_\_\_

Mechanical Subcontractor:

\_\_\_\_\_ Lic \_\_\_\_\_

Electrical Subcontractor:

\_\_\_\_\_ Lic \_\_\_\_\_

GS143-128(d) requires all single prime bidders to identify their subcontractors for the above subdivisions of work. A contractor whose bid is accepted shall not substitute any person as subcontractor in the place of the subcontractor listed in the original bid, except (i) if the listed subcontractor's bid is later determined by the contractor to be non-responsible or non-responsive or the listed subcontractor refuses to enter into a contract for the complete performance of the bid work, or (ii) with the approval of the awarding authority for good cause shown by the contractor.

## ALTERNATES:

Should any of the alternates as described in the contract documents be accepted, the amount written below shall be the amount to be "added to" the base bid.)

**GENERAL CONTRACT:**

Alternate No. G-1    (*Preferred Hardware*)

1. Base Bid Item: Any manufacturer listed in Specifications 08 7100.

2. Alternate Item: Cobin Russwin (locksets), Norton (closeers), Dorma (locks).

(Add) \_\_\_\_\_ Dollars(\$)

Alternate No. G-2    (*HVAC DDC*)

(Add) \_\_\_\_\_ Dollars(\$)

Alternate No. G-3    (*Drive*)

(Add) \_\_\_\_\_ Dollars(\$)

Alternate No. G-4    (*Sod & Irrigation*)

(Add) \_\_\_\_\_ Dollars(\$)

Alternate No. G-5    (*Wood Storage Shelving*)

(Add) \_\_\_\_\_ Dollars(\$)

Alternate No. G-6    (*Suspended Wood Ceiling*)

(Add) \_\_\_\_\_ Dollars(\$)

Alternate No. G-7    (*Interior Aluminum Frames and Lites*)

(Add) \_\_\_\_\_ Dollars(\$)

Alternate No. G-8    (*Fluid Applied Flooring in Apparatus Bay and Supporting Spaces*)

(Add) \_\_\_\_\_ Dollars(\$)

Alternate No. G-9    (*Stainless Steel Wall Base*)

(Add) \_\_\_\_\_ Dollars(\$)

## **MINORITY BUSINESS PARTICIPATION REQUIREMENTS**

---

*Provide with the bid* - Under GS 143-128.2(c) the undersigned bidder shall identify **on its bid** (Identification of Minority Business Participation Form) the minority businesses that it will use on the project with the total dollar value of the bids that will be performed by the minority businesses. **Also** list the good faith efforts (Affidavit **A**) made to solicit minority participation in the bid effort.

**NOTE:** A contractor that performs all of the work with its **own workforce** may submit an Affidavit (**B**) to that effect in lieu of Affidavit (**A**) required above. The MB Participation Form must still be submitted even if there is zero participation.

*After the bid opening* - The Owner will consider all bids and alternates and determine the lowest responsible, responsive bidder. Upon notification of being the apparent low bidder, the bidder shall then file within 72 hours of the notification of being the apparent lowest bidder, the following:

An Affidavit (**C**) that includes a description of the portion of work to be executed by minority businesses, expressed as a percentage of the total contract price, which is **equal to or more than the 10% goal** established. This affidavit shall give rise to the presumption that the bidder has made the required good faith effort and Affidavit **D** is not necessary;

**\* OR \***

**If less than the 10% goal**, Affidavit (**D**) of its good faith effort to meet the goal shall be provided. The document must include evidence of all good faith efforts that were implemented, including any advertisements, solicitations and other specific actions demonstrating recruitment and selection of minority businesses for participation in the contract.

**Note:** Bidders must always submit **with their bid** the Identification of Minority Business Participation Form listing all MB contractors, **vendors and suppliers** that will be used. If there is no MB participation, then enter none or zero on the form. Affidavit A **or** Affidavit B, as applicable, also must be submitted with the bid. Failure to file a required affidavit or documentation with the bid or after being notified apparent low bidder is grounds for rejection of the bid.

## Proposal Signature Page

The undersigned further agrees that in the case of failure on his part to execute the said contract and the bonds within ten (10) consecutive calendar days after being given written notice of the award of contract, the certified check, cash or bid bond accompanying this bid shall be paid into the funds of the owner's account set aside for the project, as liquidated damages for such failure; otherwise the certified check, cash or bid bond accompanying this proposal shall be returned to the undersigned.

Respectfully submitted this day of \_\_\_\_\_

\_\_\_\_\_  
(Name of firm or corporation making bid)

WITNESS:

\_\_\_\_\_  
(Proprietorship or Partnership)

By: \_\_\_\_\_  
Signature

Name: \_\_\_\_\_  
Print or type

Title \_\_\_\_\_  
(Owner/Partner/Pres./V.Pres)

Address \_\_\_\_\_

ATTEST:

By: \_\_\_\_\_

Title: \_\_\_\_\_  
(Corp. Sec. or Asst. Sec. only)

License No. \_\_\_\_\_

Federal I.D. No. \_\_\_\_\_

Email Address: \_\_\_\_\_

(CORPORATE SEAL)

Addendum received and used in computing bid:

Addendum No. 1 \_\_\_\_\_ Addendum No. 3 \_\_\_\_\_ Addendum No. 5 \_\_\_\_\_ Addendum No. 6 \_\_\_\_\_

Addendum No. 2 \_\_\_\_\_ Addendum No. 4 \_\_\_\_\_ Addendum No. 6 \_\_\_\_\_ Addendum No. 7 \_\_\_\_\_



# State of North Carolina AFFIDAVIT A – Listing of Good Faith Efforts

County of \_\_\_\_\_

(Name of Bidder)

Affidavit of \_\_\_\_\_

I have made a good faith effort to comply under the following areas checked:

**Bidders must earn at least 50 points from the good faith efforts listed for their bid to be considered responsive.** (1 NC Administrative Code 30 I.0101)

- ☐ **1 – (10 pts)** Contacted minority businesses that reasonably could have been expected to submit a quote and that were known to the contractor, or available on State or local government maintained lists, at least 10 days before the bid date and notified them of the nature and scope of the work to be performed.
- ☐ **2 --(10 pts)** Made the construction plans, specifications and requirements available for review by prospective minority businesses, or providing these documents to them at least 10 days before the bids are due.
- ☐ **3 – (15 pts)** Broken down or combined elements of work into economically feasible units to facilitate minority participation.
- ☐ **4 – (10 pts)** Worked with minority trade, community, or contractor organizations identified by the Office of Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses.
- ☐ **5 – (10 pts)** Attended prebid meetings scheduled by the public owner.
- ☐ **6 – (20 pts)** Provided assistance in getting required bonding or insurance or provided alternatives to bonding or insurance for subcontractors.
- ☐ **7 – (15 pts)** Negotiated in good faith with interested minority businesses and did not reject them as unqualified without sound reasons based on their capabilities. Any rejection of a minority business based on lack of qualification should have the reasons documented in writing.
- ☐ **8 – (25 pts)** Provided assistance to an otherwise qualified minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required. Assisted minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help minority businesses in establishing credit.
- ☐ **9 – (20 pts)** Negotiated joint venture and partnership arrangements with minority businesses in order to increase opportunities for minority business participation on a public construction or repair project when possible.
- ☐ **10 - (20 pts)** Provided quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

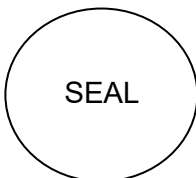
The undersigned, if apparent low bidder, will enter into a formal agreement with the firms listed in the Identification of Minority Business Participation schedule conditional upon scope of contract to be executed with the Owner. Substitution of contractors must be in accordance with GS143-128.2(d) Failure to abide by this statutory provision will constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of the minority business commitment and is authorized to bind the bidder to the commitment herein set forth.

Date: \_\_\_\_\_ Name of Authorized Officer: \_\_\_\_\_

Signature: \_\_\_\_\_

Title: \_\_\_\_\_



State of \_\_\_\_\_, County of \_\_\_\_\_

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_

Notary Public \_\_\_\_\_

My commission expires \_\_\_\_\_



# State of North Carolina --AFFIDAVIT B-- Intent to Perform Contract with Own Workforce.

County of \_\_\_\_\_

Affidavit of \_\_\_\_\_  
(Name of Bidder)

I hereby certify that it is our intent to perform 100% of the work required for the \_\_\_\_\_  
\_\_\_\_\_ contract.  
(Name of Project)

In making this certification, the Bidder states that the Bidder does not customarily subcontract elements of this type project, and normally performs and has the capability to perform and will perform all elements of the work on this project with his/her own current work forces; and

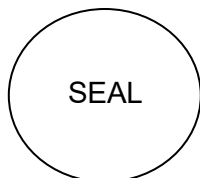
The Bidder agrees to provide any additional information or documentation requested by the owner in support of the above statement. The Bidder agrees to make a Good Faith Effort to utilize minority suppliers where possible.

The undersigned hereby certifies that he or she has read this certification and is authorized to bind the Bidder to the commitments herein contained.

Date: \_\_\_\_\_ Name of Authorized Officer: \_\_\_\_\_

Signature: \_\_\_\_\_

Title: \_\_\_\_\_



State of \_\_\_\_\_, County of \_\_\_\_\_

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_

Notary Public \_\_\_\_\_

My commission expires \_\_\_\_\_

# State of North Carolina - AFFIDAVIT C - Portion of the Work to be Performed by HUB Certified/Minority Businesses

County of \_\_\_\_\_

(Note this form is to be submitted only by the apparent lowest responsible, responsive bidder.)

If the portion of the work to be executed by HUB certified/minority businesses as defined in GS143-128.2(g) and 128.4(a),(b),(e) is equal to or greater than 10% of the bidders total contract price, then the bidder must complete this affidavit.  
This affidavit shall be provided by the apparent lowest responsible, responsive bidder within **72 hours** after notification of being low bidder.

Affidavit of \_\_\_\_\_ I do hereby certify that on the  
(Name of Bidder)

(Project Name)  
Project ID# \_\_\_\_\_ Amount of Bid \$ \_\_\_\_\_

I will expend a minimum of \_\_\_\_\_% of the total dollar amount of the contract with minority business enterprises. Minority businesses will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below.

Attach additional sheets if required

Name and Phone Number	*Minority Category	**HUB Certified Y/N	Work Description	Dollar Value

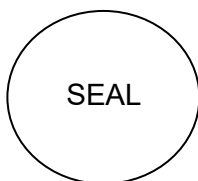
\*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

**\*\* HUB Certification with the state HUB Office required to be counted toward state participation goals.**

Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with Minority Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

Date: \_\_\_\_\_ Name of Authorized Officer: \_\_\_\_\_



Signature: \_\_\_\_\_

Title: \_\_\_\_\_

State of \_\_\_\_\_, County of \_\_\_\_\_

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_

Notary Public \_\_\_\_\_

My commission expires \_\_\_\_\_

# State of North Carolina AFFIDAVIT D – Good Faith Efforts

County of \_\_\_\_\_

(Note this form is to be submitted only by the apparent lowest responsible, responsive bidder.)

If the goal of 10% participation by HUB Certified/ minority business **is not** achieved, the Bidder shall provide the following documentation to the Owner of his good faith efforts:

Affidavit of \_\_\_\_\_ I do hereby certify that on the \_\_\_\_\_  
(Name of Bidder)

Project ID# \_\_\_\_\_ (Project Name) Amount of Bid \$ \_\_\_\_\_

I will expend a minimum of \_\_\_\_\_% of the total dollar amount of the contract with HUB certified/ minority business enterprises. Minority businesses will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below. (Attach additional sheets if required)

Name and Phone Number	*Minority Category	**HUB Certified Y/N	Work Description	Dollar Value

\*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

**\*\* HUB Certification with the state HUB Office required to be counted toward state participation goals.**

**Examples** of documentation that may be required to demonstrate the Bidder's good faith efforts to meet the goals set forth in these provisions include, but are not necessarily limited to, the following:

- Copies of solicitations for quotes to at least three (3) minority business firms from the source list provided by the State for each subcontract to be let under this contract (if 3 or more firms are shown on the source list). Each solicitation shall contain a specific description of the work to be subcontracted, location where bid documents can be reviewed, representative of the Prime Bidder to contact, and location, date and time when quotes must be received.
- Copies of quotes or responses received from each firm responding to the solicitation.
- A telephone log of follow-up calls to each firm sent a solicitation.
- For subcontracts where a minority business firm is not considered the lowest responsible sub-bidder, copies of quotes received from all firms submitting quotes for that particular subcontract.
- Documentation of any contacts or correspondence to minority business, community, or contractor organizations in an attempt to meet the goal.
- Copy of pre-bid roster
- Letter documenting efforts to provide assistance in obtaining required bonding or insurance for minority business.
- Letter detailing reasons for rejection of minority business due to lack of qualification.
- Letter documenting proposed assistance offered to minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letter of credit, including waiving credit that is ordinarily required.

Failure to provide the documentation as listed in these provisions may result in rejection of the bid and award to the next lowest responsible and responsive bidder.

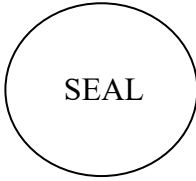
Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with Minority Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

Date: \_\_\_\_\_ Name of Authorized Officer: \_\_\_\_\_

Signature: \_\_\_\_\_

Title: \_\_\_\_\_



State of \_\_\_\_\_, County of \_\_\_\_\_

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_

Notary Public \_\_\_\_\_

My commission expires \_\_\_\_\_

## FORM OF BID BOND

KNOW ALL MEN BY THESE PRESENTS THAT \_\_\_\_\_

\_\_\_\_\_ as  
principal, and \_\_\_\_\_, as surety, who is  
duly licensed to act as surety in North Carolina, are held and firmly bound unto The  
Trustees of Brunswick Community College through  
\_\_\_\_\_ as obligee, in the penal sum of  
\_\_\_\_\_ DOLLARS, lawful money of the United States of  
America, for the payment of which, well and truly to be made, we bind ourselves, our heirs,  
executors, administrators, successors and assigns, jointly and severally, firmly by these  
presents.

Signed, sealed and dated this \_\_\_\_ day of \_\_\_\_ 20\_\_

WHEREAS, the said principal is herewith submitting proposal for  
and the principal desires to file this bid bond in lieu of making  
the cash deposit as required by G.S. 143-129.

NOW, THEREFORE, THE CONDITION OF THE ABOVE OBLIGATION is such, that  
if the principal shall be awarded the contract for which the bid is submitted and shall  
execute the contract and give bond for the faithful performance thereof within ten days after  
the award of same to the principal, then this obligation shall be null and void; but if the  
principal fails to so execute such contract and give performance bond as required by G.S.  
143-129, the surety shall, upon demand, forthwith pay to the obligee the amount set forth in  
the first paragraph hereof. Provided further, that the bid may be withdrawn as provided by  
G.S. 143-129.1

\_\_\_\_\_(SEAL)

\_\_\_\_\_(SEAL)

\_\_\_\_\_(SEAL)

\_\_\_\_\_(SEAL)

\_\_\_\_\_(SEAL)

## FORM OF CONSTRUCTION CONTRACT

(ALL PRIME CONTRACTS)

THIS AGREEMENT, made the \_\_\_\_\_ day of \_\_\_\_\_ in the year of  
20\_\_ by \_\_\_\_\_ and \_\_\_\_\_ between \_\_\_\_\_

hereinafter called the Party of the First Part and The Trustees of Brunswick Community  
College, the \_\_\_\_\_

\_\_\_\_\_ hereinafter  
called the Party of the Second Part.

### WITNESSETH:

That the Party of the First Part and the Party of the Second Part for the  
consideration herein named agree as follows:

1. Scope of Work: The Party of the First Part shall furnish and deliver all of the  
materials, and perform all of the work in the manner and form as provided by the following  
enumerated plans, specifications and documents, which are attached hereto and made a  
part thereof as if fully contained herein: advertisement; Instructions to Bidders; General  
Conditions; Supplementary General Conditions; specifications; accepted proposal;  
contract; performance bond; payment bond; power of attorney; workmen's compensation;  
public liability; property damage and builder's risk insurance certificates; approval of  
attorney general; certificate by the Office of State Budget and Management, and drawings,  
titled:

\_\_\_\_\_  
\_\_\_\_\_  
Consisting of the following sheets: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Dated: \_\_\_\_\_ and the following addenda:

Addendum No. \_\_\_\_\_ Dated: \_\_\_\_\_ Addendum No. \_\_\_\_\_ Dated: \_\_\_\_\_

Addendum No. \_\_\_\_\_ Dated: \_\_\_\_\_ Addendum No. \_\_\_\_\_ Dated: \_\_\_\_\_

Addendum No. \_\_\_\_\_ Dated: \_\_\_\_\_ Addendum No. \_\_\_\_\_ Dated: \_\_\_\_\_

Addendum No. \_\_\_\_\_ Dated: \_\_\_\_\_ Addendum No. \_\_\_\_\_ Dated: \_\_\_\_\_

2. That the Party of the First Part shall commence work to be performed under this  
agreement on a date to be specified in a written order of the Party of the Second Part and  
shall fully complete all work hereunder within \_\_\_\_\_ consecutive calendar days

from said date. For each day in excess thereof, liquidated damages shall be as stated in Supplementary General Conditions. The Party of the First Part, as one of the considerations for the awarding of this contract, shall furnish to the Party of the Second Part a construction schedule setting forth planned progress of the project broken down by the various divisions or part of the work and by calendar days as outlined in Article 14 of the General Conditions of the Contract.

3. The Party of the Second Part hereby agrees to pay to the Party of the First Part for the faithful performance of this agreement, subject to additions and deductions as provided in the specifications or proposal, in lawful money of the United States as follows:

---

(\$ \_\_\_\_\_).

Summary of Contract Award:

4. In accordance with Article 31 and Article 32 of the General Conditions of the Contract, the Party of the Second Part shall review, and if approved, process the Party of the First Party's pay request within 30 days upon receipt from the Designer. The Party of the Second Part, after reviewing and approving said pay request, shall make payments to the Party of the First Part on the basis of a duly certified and approved estimate of work performed during the preceding calendar month by the First Party, less five percent (5%) of the amount of such estimate which is to be retained by the Second Party until all work has been performed strictly in accordance with this agreement and until such work has been accepted by the Second Party. The Second Party may elect to waive retainage requirements after 50 percent of the work has been satisfactorily completed on schedule as referred to in Article 31 of the General Conditions.

5. Upon submission by the First Party of evidence satisfactory to the Second Party that all payrolls, material bills and other costs incurred by the First Party in connection with the construction of the work have been paid in full, final payment on account of this agreement shall be made within thirty (30) days after the completion by the First Party of all work covered by this agreement and the acceptance of such work by the Second Party.

6. It is further mutually agreed between the parties hereto that if at any time after the execution of this agreement and the surety bonds hereto attached for its faithful performance, the Second Party shall deem the surety or sureties upon such bonds to be unsatisfactory, or if, for any reason, such bonds cease to be adequate to cover the performance of the work, the First Party shall, at its expense, within five (5) days after the receipt of notice from the Second Party so to do, furnish an additional bond or bonds in such form and amount, and with such surety or sureties as shall be satisfactory to the Second Party. In such event no further payment to the First Party shall be deemed to be due under this agreement until such new or additional security for the faithful performance of the work shall be furnished in manner and form satisfactory to the Second Party.

7. The Party of the First Part attest that it and all of its subcontractors have fully complied with all requirements of NCGS 64 Article 2 in regards to E-Verification as required by Section 2.(c) of Session Law 2013-418, codified as N.C. Gen. Stat. § 143-129(j).

IN WITNESS WHEREOF, the Parties hereto have executed this agreement on the day and date first above written in \_\_\_\_\_ counterparts, each of which shall without proof or accounting for other counterparts, be deemed an original contract.

Witness:

\_\_\_\_\_  
Contractor: (Trade or Corporate Name)

\_\_\_\_\_  
(Proprietorship or Partnership)

By: \_\_\_\_\_

Title: \_\_\_\_\_  
(Owner, Partner, or Corp. Pres. or Vice Pres. only)

Attest: (Corporation)

By: \_\_\_\_\_

Title: \_\_\_\_\_  
(Corp. Sec. or Asst. Sec. only)

The Trustees of Brunswick Community College

(CORPORATE SEAL)

\_\_\_\_\_  
(Agency, Department or Institution)

Witness:

\_\_\_\_\_

By: \_\_\_\_\_

Title: \_\_\_\_\_



## FORM OF PERFORMANCE BOND

Date of Contract: \_\_\_\_\_

Date of Execution: \_\_\_\_\_

Name of Principal  
(Contractor) \_\_\_\_\_

Name of Surety: \_\_\_\_\_

Name of Contracting  
Body: \_\_\_\_\_

Amount of Bond: \_\_\_\_\_

Project \_\_\_\_\_

KNOW ALL MEN BY THESE PRESENTS, that we, the principal and surety above named, are held and firmly bound unto the above named contracting body, hereinafter called the contracting body, in the penal sum of the amount stated above for the payment of which sum well and truly to be made, we bind, ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the principal entered into a certain contract with the contracting body, identified as shown above and hereto attached:

NOW, THEREFORE, if the principal shall well and truly perform and fulfill all the undertakings, covenants, terms, conditions and agreements of said contract during the original term of said contract and any extensions thereof that may be granted by the contracting body, with or without notice to the surety, and during the life of any guaranty required under the contract, and shall also well and truly perform and fulfill all the undertakings, covenants, terms, conditions and agreements of any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the surety being hereby waived, then, this obligation to be void; otherwise to remain in full force and virtue.

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

Executed in \_\_\_\_\_ counterparts.

Witness:

\_\_\_\_\_  
(Proprietorship or Partnership)

Attest: (Corporation)

By: \_\_\_\_\_

Title: \_\_\_\_\_  
(Corp. Sec. or Asst. Sec. only)

(Corporate Seal)

Witness:

\_\_\_\_\_

Countersigned:

\_\_\_\_\_

\_\_\_\_\_  
(N.C. Licensed Resident Agent)

\_\_\_\_\_

\_\_\_\_\_  
Name and Address-Surety Agency

\_\_\_\_\_

\_\_\_\_\_  
Surety Company Name and N.C.  
Regional or Branch Office Address

\_\_\_\_\_  
Contractor: (Trade or Corporate Name)

By: \_\_\_\_\_

Title: \_\_\_\_\_  
(Owner, Partner, or Corp. Pres. or Vice  
Pres. only)

\_\_\_\_\_  
(Surety Company)

By: \_\_\_\_\_

Title: \_\_\_\_\_  
(Attorney in Fact)

(Surety Corporate Seal)

## FORM OF PAYMENT BOND

Date of Contract: \_\_\_\_\_

Date of Execution: \_\_\_\_\_

Name of Principal  
(Contractor) \_\_\_\_\_

Name of Surety: \_\_\_\_\_

Name of Contracting  
Body: \_\_\_\_\_

Amount of Bond: \_\_\_\_\_

Project \_\_\_\_\_

KNOW ALL MEN BY THESE PRESENTS, that we, the principal and surety above named, are held and firmly bound unto the above named contracting body, hereinafter called the contracting body, in the penal sum of the amount stated above for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the principal entered into a certain contract with the contracting body identified as shown above and hereto attached:

NOW, THEREFORE, if the principal shall promptly make payment to all persons supplying labor/material in the prosecution of the work provided for in said contract, and any and all duly authorized modifications of said contract that may hereafter be made, notice of which modifications to the surety being hereby waived, then this obligation to be void; otherwise to remain in full force and virtue.

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

Executed in \_\_\_\_\_ counterparts.

Witness:

\_\_\_\_\_  
(Proprietorship or Partnership)

Attest: (Corporation)

By: \_\_\_\_\_

Title: \_\_\_\_\_  
(Corp. Sec. or Asst. Sec.. only)

(Corporate Seal)

Witness:

\_\_\_\_\_

Countersigned:

\_\_\_\_\_

\_\_\_\_\_  
(N.C. Licensed Resident Agent)

\_\_\_\_\_

\_\_\_\_\_  
Name and Address-Surety Agency

\_\_\_\_\_

\_\_\_\_\_  
Surety Company Name and N.C.  
Regional or Branch Office Address

\_\_\_\_\_  
Contractor: (Trade or Corporate Name)

By: \_\_\_\_\_

Title \_\_\_\_\_  
(Owner, Partner, or Corp. Pres. or Vice  
Pres. only)

\_\_\_\_\_  
(Surety Company)

By: \_\_\_\_\_

Title: \_\_\_\_\_  
(Attorney in Fact)

(Surety Corporate Seal)

## Sheet for Attaching Power of Attorney

## Sheet for Attaching Insurance Certificates

## APPROVAL OF THE ATTORNEY GENERAL

**CERTIFICATION BY THE OFFICE OF STATE  
BUDGET AND MANAGEMENT**

Provision for the payment of money to fall due and payable by the

---

under this agreement has been provided for by allocation made and is available for the purpose of carrying out this agreement.

This \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_.

Signed \_\_\_\_\_  
Budget Officer



STATE OF NORTH CAROLINA  
COUNTY SALES AND USE TAX REPORT  
SUMMARY TOTALS AND CERTIFICATION

CONTRACTOR: \_\_\_\_\_

Page 1 of \_\_\_\_\_

PROJECT: \_\_\_\_\_

FOR PERIOD: \_\_\_\_\_

	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL FOR COUNTY OF:	TOTAL ALL COUNTIES
CONTRACTOR							
SUBCONTRACTOR(S)*							
COUNTY TOTAL							

\* Attach subcontractor(s) report(s)

\*\* Must balance with Detail Sheet(s)

I certify that the above figures do not include any tax paid on supplies, tools and equipment which were used to perform this contract and only includes those building materials, supplies, fixtures and equipment which actually became a part of or annexed to the building or structure. I certify that, to the best of my knowledge, the information provided here is true, correct, and complete.

Sworn to and subscribed before me,

This the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_

\_\_\_\_\_  
Signed

\_\_\_\_\_  
Notary Public

My Commission Expires: \_\_\_\_\_

\_\_\_\_\_  
Print or Type Name of Above

Seal

NOTE:

This certified statement may be subject to audit.

# STATE OF NORTH CAROLINA SALES AND USE TAX REPORT DETAIL

CONTRACTOR: \_\_\_\_\_

Page 2 of       

SUBCONTRACTOR \_\_\_\_\_

FOR PERIOD: \_\_\_\_\_

PROJECT: \_\_\_\_\_

PURCHASE DATE	VENDOR NAME	INVOICE NUMBER	TYPE OF PROPERTY	INVOICE TOTAL	COUNTY TAX PAID	COUNTY OF SALE *
				\$	\$	
				TOTAL:	\$	

\* If this is an out-of-state vendor, the County of Sale should be the county to which the merchandise was shipped.

## ARCHITECTURAL

### Sawyer Sherwood & Associate Architecture

124 Market Street  
Wilmington, NC 28401  
Tel: 910-762-0892



Doug Sherwood, AIA  
(Email: [doug@s2a3.com](mailto:doug@s2a3.com))

#### DIVISION 01

##### GENERAL REQUIREMENTS

- 01 1000 Summary
- 01 2000 Price and Payment Procedures
- 01 2300 Alternates
- 01 2500 Substitution Procedures
- 01 3000 Administrative Requirements
- 01 3216 Construction Progress Schedule
- 01 4000 Quality Requirements
- 01 5000 Temporary Facilities and Controls
- 01 5213 Field Offices and Sheds
- 01 5813 Temporary Project Signage
- 01 6000 Product Requirements
- 01 7000 Execution and Closeout Requirements
- 01 7800 Closeout Submittals
- 01 7900 Demonstration and Training

#### DIVISION 03

##### CONCRETE

- 03 3511 Concrete Floor Finishes

#### DIVISION 04

##### MASONRY

- 04 2000 Unit Masonry

#### DIVISION 05

##### METALS

- 05 5100 Metal Stairs

#### DIVISION 06

##### WOOD, PLASTIC, AND COMPOSITES

- 06 1000 Rough Carpentry
- 06 4100 Architectural Wood Casework
- 06 8316 Fiberglass Reinforced Paneling

#### DIVISION 07

##### THERMAL AND MOISTURE PROTECTION 07

- 2100 Thermal Insulation
- 07 2500 Weather Barriers
- 07 4213 Metal Wall Panels
- 07 5400 Thermoplastic Membrane Roofing 07
- 6200 Sheet Metal Flashing and Trim
- 07 7100 Roof Specialties
- 07 8123 Intumescent Fire Protection
- 07 8400 Firestopping
- 07 9200 Joint Sealants

**DIVISION 08**

**OPENINGS**

08 1113 Hollow Metal Doors and Frames  
08 1116 Aluminum Doors and Frames  
08 1213 Hollow Metal Frames  
08 1416 Flush Wood Doors  
08 3100 Access Doors and Panels  
08 3500 Folding Doors  
08 4313 Aluminum-Framed Storefronts  
08 5113 Aluminum Windows  
08 7100 Door Hardware  
08 8000 Glazing  
08 8813 Fire-Rated Glazing  
08 9100 Louvers

**DIVISION 09**

**FINISHES**

09 0561 Common Work Results for Flooring Preparation  
09 2116 Gypsum Board Assemblies  
09 3000 Tiling  
09 5100 Acoustical Ceilings  
09 5426 Suspended Wood Ceilings  
09 6500 Resilient Flooring  
09 6700 Fluid-Applied Flooring  
09 6813 Tile Carpeting  
09 8430 Sound-Absorbing Wall and Ceiling Units  
09 9113 Exterior Painting  
09 9123 Interior Painting

**DIVISION 10**

**SPECIALTIES**

10 1100 Visual Display Units  
10 1200 Display Cases  
10 1416 Plaques  
10 1419 Dimensional Letter Signage  
10 1423 Panel Signage  
10 2113.17 Phenolic Toilet Compartments  
10 2600 Wall and Door Protection  
10 2800 Toilet, Bath, and Laundry Accessories  
10 4400 Fire Protection Specialties  
10 5129 Phenolic Lockers  
10 6000 Wood Storage Shelving

**DIVISION 12**

**FURNISHINGS**

12 2400 Window Shades  
12 3600 Countertops  
12 4813 Entrance Floor Mats and Frames

**DIVISION 31**

**EARTHWORK**

31 3116 Termite Control

**DIVISION 32**

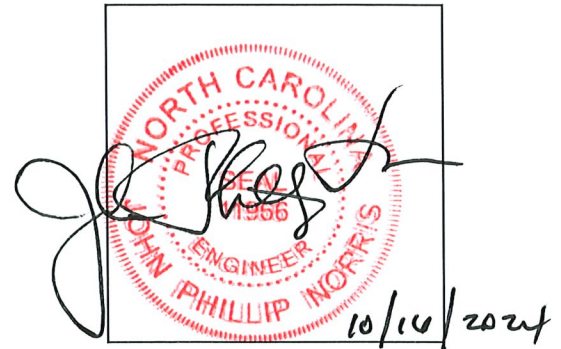
**EXTERIOR IMPROVEMENTS**

32 8423 Underground Sprinklers

**END OF ARCHITECTURAL SPECIFICATIONS**

**CIVIL**

**Norris & Bland Consulting Engineers, P.C.**  
1429 Ash-Little River Rd.  
Ash, NC 28420  
Tel: 910-287-5900



John Phillip Norris, PE  
(Email: pnorris@nbengr.com)

**DIVISION 31**

**EARTHWORK**

31 2000 Earth Moving

**DIVISION 32**

**EXTERIOR IMPROVEMENTS**

32 1000 Bases, Ballasts, and Paving

32 1313 Concrete Paving

**DIVISION 33**

**UTILITIES**

33 0507.13 Directional Drilling

33 1400 Water Utility Transmission and Distribution

33 3000 Sanitary Sewerage

33 3216 Packaged Wastewater Grinder Pump Assemblies

33 4000 Stormwater Utilities

**END OF CIVIL SPECIFICATIONS**

## STRUCTURAL

**Woods Engineering, PA**  
254 N. Front Street, Suite 201  
Wilmington, NC 28401  
Tel: 910-343-8007



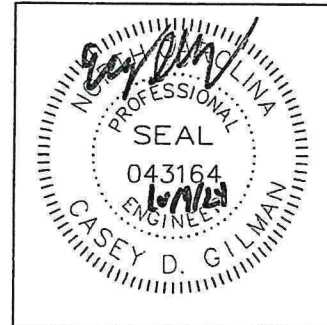
**Adam Sisk, PE, SE**  
(Email: [adam@woodseng.com](mailto:adam@woodseng.com))

<b>DIVISION 01</b>	<b>GENERAL REQUIREMENTS</b> 01 4533 Special Inspections
<b>DIVISION 03</b>	<b>CONCRETE</b> 03 3000 Cast-in-Place Concrete
<b>DIVISION 05</b>	<b>METALS</b> 05 1200 Structural Steel Framing 05 3100 Steel Decking 05 4000 Cold-Formed Metal Framing

**END OF STRUCTURAL SPECIFICATIONS**

## FIRE PROTECTION & PLUMBING

**Cheatham and Associates, P.A.**  
3412 Enterprise Drive  
Wilmington, NC 28405  
Tel: 910-452-4210  
NC License No. C-1073



**Casey D. Gilman, PE, LEED AP**  
(Email: [cgilman@cheathamapa.com](mailto:cgilman@cheathamapa.com))

### DIVISION 21

#### FIRE SUPPRESSION

- 21 0100 Basic Fire Protection Requirements
- 21 0517 Sleeves and Sleeve Seals for Fire-Suppression Piping
- 21 0518 Escutcheons for Fire-Suppression Piping
- 21 0553 Identification for Fire-Suppression Piping and Equipment
- 21 1313 Wet-Pipe Sprinkler Systems

### DIVISION 22

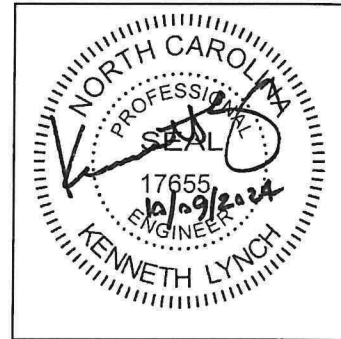
#### PLUMBING

- 22 0100 Basic Plumbing Requirements
- 22 0513 Common Motor Requirements for Plumbing Equipment
- 22 0516 Expansion Fittings and Loops for Plumbing Piping
- 22 0517 Sleeves and Sleeve Seals for Plumbing Piping
- 22 0518 Escutcheons for Plumbing Piping
- 22 0519 Meters and Gages for Plumbing Piping
- 22 0523 General-Duty Valves for Plumbing Piping
- 22 0529 Hangers and Supports for Plumbing Piping and Equipment
- 22 0553 Identification for Plumbing Piping and Equipment
- 22 0719 Plumbing Piping Insulation
- 22 1116 Domestic Water Piping
- 22 1119 Domestic Water Piping Specialties
- 22 1123 Domestic Water Pumps
- 22 1316 Sanitary Waste and Vent Piping
- 22 1319 Sanitary Waste Piping Specialties
- 22 1323 Sanitary Waste Interceptors
- 22 1413 Facility Storm Drainage Piping
- 22 1423 Storm Drainage Piping Specialties
- 22 1500 Fuel Gas Piping
- 22 3300 Electric, Domestic-Water Heaters
- 22 3400 Fuel-Fired, Domestic-Water Heaters
- 22 4213.13 Commercial Water Closets
- 22 4213.16 Commercial Urinals
- 22 4216.13 Commercial Lavatories
- 22 4216.16 Commercial Sinks
- 22 4223 Commercial Showers
- 22 4500 Emergency Plumbing Fixtures
- 22 4716 Pressure Water Coolers

**END OF FIRE PROTECTION & PLUMBING SPECIFICATIONS**

## MECHANICAL

**Cheatham and Associates, P.A.**  
3412 Enterprise Drive  
Wilmington, NC 28405  
Tel: 910-452-4210  
**NC License No. C-1073**



**Kenneth Lynch, PE, LEED AP**  
(Email: [klynch@cheathampa.com](mailto:klynch@cheathampa.com))

### DIVISION 23

#### HEATING, VENTILATION AND AIR-CONDITIONING

- 23 0500 Basic HVAC Requirements
- 23 0513 Common Motor Requirements for HVAC Equipment
- 23 0517 Sleeves and Sleeve Seals for HVAC Piping
- 23 0518 Escutcheons for HVAC Piping
- 23 0529 Hangers and Supports for HVAC Piping and Equipment
- 23 0549 Vibration Controls for HVAC
- 23 0553 Identification For HVAC Piping and Equipment
- 23 0593 Testing, Adjusting, and Balancing for HVAC
- 23 0713 Duct Insulation
- 23 0719 HVAC Piping Insulation
- 23 0900 Instrumentation and Control for HVAC
- 23 2113 Hydronic Piping
- 23 2300 Refrigerant Piping
- 23 3113 Metal Ducts
- 23 3300 Air Duct Accessories
- 23 3346 Flexible Ducts
- 23 3423 HVAC Power Ventilators
- 23 3713 Air Diffusers
- 23 3714 Registers and Grilles
- 23 3723 HVAC Gravity Ventilators
- 23 4100 Particulate Air Filtration
- 23 7223 Packaged Indoor Fixed Plate Energy Recovery Units
- 23 8126 Split-System Air-Conditioners
- 23 8127 Ductless-Split-System Air-Conditioners
- 23 8239 Wall Unit Heaters

**END OF MECHANICAL SPECIFICATIONS**



## ELECTRICAL, COMMUNICATIONS, & FIRE ALARM

**Cheatham and Associates, P.A.**  
3412 Enterprise Drive  
Wilmington, NC 28405  
Tel: 910-452-4210  
**NC License No. C-1073**



**Mark A. Ciarrocca, PE**  
(Email: [mciarrocca@cheathampa.com](mailto:mciarrocca@cheathampa.com))

### DIVISION 26

#### ELECTRICAL

- 26 0000 Electrical, Basics
- 26 0500 Basic Materials and Methods
- 26 0519 Conductors and Cables
- 26 0526 Grounding and Bonding
- 26 0533 Raceways and Boxes
- 26 0538 Wire Mesh Cable Tray
- 26 0553 Electrical Identification
- 26 0923 Lighting Control Devices
- 26 2200 Dry-Type Transformers (600 V and less)
- 26 2416 Panelboards
- 26 2726 Wiring Devices
- 26 2816 Enclosed Switches and Circuit Breakers
- 26 4313 Surge Protective Devices
- 26 5119 LED Interior Lighting

### DIVISION 27

#### COMMUNICATIONS

- 27 1100 Communications Equipment Room Fittings
- 27 1500 Communications Horizontal Cabling

### DIVISION 28

#### ELECTRONIC SAFETY AND SECURITY

- 28 3111 Digital, Addressable Fire Alarm System
- 28 5000 Emergency Responder Communication Coverage System

**END OF ELECTRICAL, COMMUNICATIONS, & FIRE ALARM SPECIFICATIONS**

## TABLE OF CONTENTS

Prepared by the professional responsible for their discipline, see seal pages:

Architectural – Sawyer Sherwood & Associate, Doug Sherwood, AIA

Civil – Norris & Bland Consulting Engineers, Phillip Norris, PE

Structural – Woods Engineering – Adam Sisk, PE

Plumbing & Fire Protection – Cheatham and Associate, Casey Gilman, PE

Mechanical – Cheatham and Associate, Ken Lynch, PE

Electrical – Cheatham and Associate, Mark Ciarrocca, PE

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33 3000 Sanitary Sewerage  
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33 4000 Stormwater Utilities

**SECTION 01 1000  
SUMMARY**

**PART 1 GENERAL**

**1.01 PROJECT**

- A. Project Name: Brunswick Community College Alan Holden Public Safety Center.
- B. Owner's Name: The Trustees of Brunswick Community College, Supply, NC.
- C. Architect's Name: Sawyer Sherwood & Associate, P.C.
- D. The Project consists of the construction of of sitework, including removal of all ponds previously used for the Aquaculture program, new parking lots, stormwater improvements, utility connections, and landscaping. Building construction includes a new public safety building of roughly 28,840sf. .

**1.02 CONTRACT DESCRIPTION**

- A. Contract Type: A single prime contract based on a Stipulated Price.

**1.03 OWNER OCCUPANCY**

- A. Owner intends to occupy the Project upon Final Acceptance.
- B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- C. Schedule the Work to accommodate Owner occupancy.

**1.04 CONTRACTOR USE OF SITE AND PREMISES**

- A. Construction Operations: Limited to areas noted on Drawings.
- B. Provide access to and from site as required by law and by Owner:
  - 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
  - 2. Do not obstruct roadways, sidewalks, or other public ways without permit.

**END OF SECTION**

**SECTION 01 2000  
PRICE AND PAYMENT PROCEDURES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Procedures for preparation and submittal of applications for progress payments.
- B. Documentation of changes in Contract Sum and Contract Time.
- C. Change procedures.
- D. Correlation of Contractor submittals based on changes.
- E. Procedures for preparation and submittal of application for final payment.

**1.02 RELATED REQUIREMENTS**

- A. General and Supplementary General Conditions: Additional requirements for progress payments, final payment, changes in the Work.
- B. Section 01 2200 - Unit Prices: Monetary values of unit prices; Payment and modification procedures relating to unit prices.

**1.03 SCHEDULE OF VALUES**

- A. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.
- B. Forms filled out by hand will not be accepted.
- C. Submit Schedule of Values in triplicate within 15 days after date of Owner-Contractor Agreement.
- D. Include in each line item, the amount of Allowances specified in this section. For unit cost Allowances, identify quantities taken from Contract Documents multiplied by the unit cost to achieve the total for the item.
- E. Revise schedule to list approved Change Orders, with each Application For Payment.

**1.04 APPLICATIONS FOR PROGRESS PAYMENTS**

- A. Payment Period: Submit at intervals stipulated in the Agreement.
- B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
- C. Forms filled out by hand will not be accepted.
- D. Execute certification by signature of authorized officer.
- E. Submit one electronic and three hard-copies of each Application for Payment.
- F. Include the following with the application:
  - 1. Transmittal letter as specified for submittals in Section 01 3000.
  - 2. Construction progress schedule, revised and current as specified in Section 01 3000.
  - 3. Partial release of liens from major subcontractors and vendors.

**1.05 MODIFICATION PROCEDURES**

- A. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor.
- B. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
  - 1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
  - 2. Promptly execute the change.
- C. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any

01 2000 Price and Payment  
Procedures

overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 10 days.

- D. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation.
- E. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
  - 1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
  - 2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
  - 3. For pre-determined unit prices and quantities, the amount will be based on the fixed unit prices.
- F. Substantiation of Costs: Provide full information required for evaluation.
  - 1. Provide the following data:
    - a. Quantities of products, labor, and equipment.
    - b. Taxes, insurance, and bonds.
    - c. Overhead and profit.
    - d. Justification for any change in Contract Time.
    - e. Credit for deletions from Contract, similarly documented.
- G. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
- H. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.
- I. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
- J. Promptly enter changes in Project Record Documents.

**1.06 APPLICATION FOR FINAL PAYMENT**

- A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- B. Application for Final Payment will not be considered until the following have been accomplished:
  - 1. All closeout procedures specified in Section 01 7000.

**END OF SECTION**



**SECTION 01 2300  
ALTERNATES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Description of Alternates.
- B. Procedures for pricing Alternates.
- C. Documentation of changes to Contract Price and Contract Time.

**1.02 ACCEPTANCE OF ALTERNATES**

- A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.
- B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

**1.03 SCHEDULE OF ALTERNATES**

- A. Alternate No. G-1 - Preferred Hardware:
  - 1. Base Bid Item: Any manufacturer listed in Specifications 08 7100.
  - 2. Alternate Item: Cobin Russwin (locksets), Norton (closeers), Dorma (locks).
- B. Alternate No. G-2 - DDC:
  - 1. Base Bid Item: Per Specification, "Controls shall be DDC BACnet BAS connected to and fully incorporated into Brunswick Community College's existing BACnet Allerton central system including all necessary integration, updating of system's graphics pages, software, etc... as necessary".
  - 2. Alternate Item: For proprietary system, provide cost to add to the Base Bid for new DDC BAS control system to be DDC BACnet Allerton installed by Hoffman Building Technologies connecting to the new building's Ethernet and connecting to the existing Allerton controls on the Campus' on site computer in the Maintenance Office, including all necessary integration, updating of system's graphics pages, software, etc.... as necessary.
- C. Alternate No. G-3 - Drive:
  - 1. Base Bid Item: Single drive from College Road leading to parking lot and apparatus bay. Drive from apparatus bay to College Road. As shown
  - 2. Alternate Item: Secondary drive from College Road leading to parking lot. All site work including stormwater drainage and site lighting coordination is to be included. As called out on Civil Drawings.
- D. Alternate No. G-4 - Sod and Irrigation:
  - 1. Base Bid Item: All landscaping and seeding as called for on Civil Drawings.
  - 2. Alternate Item: Sod and irrigation in areas identified on Civil Drawings.
- E. Alternate No. G-5 - Wood Storage Shelving:
  - 1. Base Bid Item: None.
  - 2. Alternate Item: Section 10 6000 and as identified on Architectural Drawing.
- F. Alternate No. G-6 - Suspended Wood Ceiling:
  - 1. Base Bid Item: Section 09 5100 Acoustical Ceilings and Drawing number A1.2 including all mechanical, electrical, and fire protection.
  - 2. Alternate Item: Section 09 5426 Suspended Wood Ceilings and Drawing number A1.2 including all mechanical, electrical, and fire protection.
- G. No. G-7 - Interior Aluminum Frames and Lites:
  - 1. Base Bid Item: Section 08 1213 Hollow Metal Frames and Drawing number A1.0, A1.1, A6.0, A6.1 & A6.2 including Painting.
  - 2. Alternate Item: Section 08 1116 Aluminum Doors & Frames and Drawing number A1.0, A1.1, A6.0, A6.1 & A6.2 including all door frames in metal stud and gypsum wall board walls. Door frames in concrete masonry walls remain hollow metal.

- H. Alternate No. G-8 - Fluid Applied Flooring in Apparatus Bay and Supporting Spaces:
  - 1. Base Bid Item: Section 03 3351 Concrete Floor Finishes and Drawing number A7.5.
  - 2. Alternate Alternate Item: Section 09 6700 Fluid Applied Flooring 09 6700 Fluid Applied Flooring and Drawing numbers A6.0 & A7.5.
- I. Alternate No. G-9 - Stainless Steel Wall Base:
  - 1. Base Bid Item: Section 09 6500 Resilient Flooring09 6500 09 6500 Resilient Flooring09 6500 and Drawing numbers A6.0 & A7.0.
  - 2. Alternate Item: Drawing detail 8-A7.5 including Lobby 100, V-1, V-2, H-2, H-3, H-4, H-5 & H-6.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

**SECTION 01 2500  
SUBSTITUTION PROCEDURES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Procedural requirements for proposed substitutions.

**1.02 DEFINITIONS**

- A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
  - 1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
    - a. Unavailability.
    - b. Regulatory changes.
  - 2. Substitutions for Convenience: Will not be considered post bid date.

**1.03 REFERENCE STANDARDS**

- A. CSI/CSC Form 1.5C - Substitution Request (During the Bidding/Negotiating Stage); Current Edition.
- B. CSI/CSC Form 13.1A - Substitution Request (After the Bidding/Negotiating Phase); Current Edition.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 GENERAL REQUIREMENTS**

- A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
  - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
  - 2. Agrees to provide the same warranty for the substitution as for the specified product.
  - 3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
  - 4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
  - 5. Waives claims for additional costs or time extension that may subsequently become apparent.
  - 6. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
- B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
  - 1. Note explicitly any non-compliant characteristics.
- C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
  - 1. Forms indicated in the Project Manual are adequate for this purpose, and must be used.
- D. Limit each request to a single proposed substitution item.
  - 1. Submit an electronic document, combining the request form with supporting data into single document.

**3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT**

- A. Submittal Time Restrictions:
  - 1. Instructions to Bidders specifies time restrictions and the documents required for submitting substitution requests during the bidding period.
- B. Submittal Form (before award of contract):

1. Submit substitution requests by completing CSI/CSC Form 1.5C - Substitution Request. See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.

### **3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION**

- A. Submittal Form (after award of contract):
  1. Submit substitution requests by completing CSI/CSC Form 13.1A - Substitution Request (After Bidding/Negotiating). See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.

### **3.04 RESOLUTION**

- A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.
- B. Architect will notify Contractor in writing of decision to accept or reject request.

### **3.05 CLOSEOUT ACTIVITIES**

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

**END OF SECTION**

**SECTION 01 3000  
ADMINISTRATIVE REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. General administrative requirements.
- B. Preconstruction meeting.
- C. Progress meetings.
- D. Construction progress schedule.
- E. Progress photographs.
- F. Coordination drawings.
- G. Submittals for review and project closeout.
- H. Number of copies of submittals.
- I. Requests for Interpretation (RFI) procedures.
- J. Submittal procedures.

**1.02 GENERAL ADMINISTRATIVE REQUIREMENTS**

- A. Comply with requirements of Section 01 7000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
- B. Make the following types of submittals to Architect:
  - 1. Requests for Interpretation (RFI).
  - 2. Requests for substitution.
  - 3. Shop drawings, product data, and samples.
  - 4. Test and inspection reports.
  - 5. Design data.
  - 6. Manufacturer's instructions and field reports.
  - 7. Applications for payment and change order requests.
  - 8. Progress schedules.
  - 9. Coordination drawings.
  - 10. Correction Punch List and Final Correction Punch List for Substantial Completion.
  - 11. Closeout submittals.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 PRECONSTRUCTION MEETING**

- A. Schedule meeting after Notice of Award.
- B. Attendance Required:
  - 1. Owner.
  - 2. Architect.
  - 3. Contractor.
- C. Agenda:
  - 1. Execution of Owner-Contractor Agreement.
  - 2. Submission of executed bonds and insurance certificates.
  - 3. Distribution of Contract Documents.
  - 4. Submission of list of subcontractors, schedule of values, and progress schedule.
  - 5. Submission of initial Submittal schedule.
  - 6. Designation of personnel representing the parties to Contract and Architect.
  - 7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
  - 8. Scheduling.

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Requirements

- D. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

**3.02 PROGRESS MEETINGS**

- A. Schedule and administer meetings throughout progress of the work at maximum monthly intervals.
- B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.
- C. Attendance Required:
  - 1. Contractor.
  - 2. Owner.
  - 3. Architect.
  - 4. Contractor's superintendent.
  - 5. Major subcontractors.
- D. Agenda:
  - 1. Review minutes of previous meetings.
  - 2. Review of work progress.
  - 3. Field observations, problems, and decisions.
  - 4. Identification of problems that impede, or will impede, planned progress.
  - 5. Review of submittals schedule and status of submittals.
  - 6. Review of RFIs log and status of responses.
  - 7. Review of off-site fabrication and delivery schedules.
  - 8. Maintenance of progress schedule.
  - 9. Corrective measures to regain projected schedules.
  - 10. Planned progress during succeeding work period.
  - 11. Maintenance of quality and work standards.
  - 12. Effect of proposed changes on progress schedule and coordination.
  - 13. Other business relating to work.
- E. Record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, participants, and those affected by decisions made.

**3.03 CONSTRUCTION PROGRESS SCHEDULE**

- A. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- B. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
  - 1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- C. Within 10 days after joint review, submit complete schedule.
- D. Submit updated schedule with each Application for Payment.

**3.04 PROGRESS PHOTOGRAPHS**

- A. Submit new photographs at least once a month, within 3 days after being taken.
- B. Photography Type: Digital; electronic files.
- C. Provide photographs of site and construction throughout progress of work pro photographer, acceptable to Architect.
- D. In addition to periodic, recurring views, take photographs of each of the following events:
  - 1. Excavations in progress.
  - 2. Foundations in progress and upon completion.
  - 3. Structural framing in progress and upon completion.
  - 4. Enclosure of building, upon completion.

### 3.05 COORDINATION DRAWINGS

- A. Review drawings prior to submission to Architect.

### 3.06 REQUESTS FOR INTERPRETATION (RFI)

- A. Definition: A request seeking one of the following:
1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
  2. A resolution to an issue which has arisen due to field conditions and affects design intent.
- B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.
- C. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
- D. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
1. Official Project name and number, and any additional required identifiers established in Contract Documents.
  2. Owner's, Architect's, and Contractor's names.
  3. Discrete and consecutive RFI number, and descriptive subject/title.
  4. Issue date, and requested reply date.
  5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
  6. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.
- E. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.
- F. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
1. Indicate current status of every RFI. Update log promptly and on a regular basis.
  2. Note dates of when each request is made, and when a response is received.
  3. Highlight items requiring priority or expedited response.
- G. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
- H. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
  2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
  3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.

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Requirements

4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

**3.07 SUBMITTAL SCHEDULE**

- A. Submit to Architect for review a schedule for submittals in tabular format.
  1. Submit at the same time as the preliminary schedule specified in Section - 01 3216 - Construction Progress Schedule.
  2. Coordinate with Contractor's construction schedule and schedule of values.
  3. Format schedule to allow tracking of status of submittals throughout duration of construction.
  4. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), and description of item of work covered.

**3.08 SUBMITTALS FOR REVIEW**

- A. When the following are specified in individual sections, submit them for review:
  1. Product data.
  2. Design data.
  3. Shop drawings.
  4. Samples for selection.
  5. Samples for verification.
- B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.
- C. Samples will be reviewed for aesthetic, color, or finish selection.
- D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - Closeout Submittals.

**3.09 SUBMITTALS FOR INFORMATION**

- A. When the following are specified in individual sections, submit them for information:
  1. Certificates.
  2. Test reports.
  3. Inspection reports.
  4. Manufacturer's instructions.
  5. Manufacturer's field reports.
  6. Other types indicated.
- B. Submit for Architect's knowledge as contract administrator or for Owner.

**3.10 SUBMITTALS FOR PROJECT CLOSEOUT**

- A. Submit Correction Punch List for Final Completion.
- B. Submit Final Correction Punch List for Final Completion.
- C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 7800 - Closeout Submittals:
  1. Project record documents.
  2. Operation and maintenance data.
  3. Warranties.
  4. Bonds.
  5. Other types as indicated.
- D. Final Property Survey.
- E. Submit for Owner's benefit during and after project completion.



### 3.11 NUMBER OF COPIES OF SUBMITTALS

- A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.
- B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
  - 1. After review, produce duplicates.
  - 2. Retained samples will not be returned to Contractor unless specifically so stated.

### 3.12 SUBMITTAL PROCEDURES

- A. General Requirements:
  - 1. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
    - a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
  - 2. Schedule submittals to expedite the Project, and coordinate submission of related items.
    - a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
    - b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
  - 3. Organize submittals base on Specificaiton Section.
    - a. Name electronic files by Specification Section 00 0000 name of submittal.
    - b. When submittal contains products that were approved substitutions during bidding, include the approved CSI form as part of the submittal.
    - c. When revised for resubmission, identify all changes made since previous submission and indcude all documents pertaining to that submittal.
- B. Product Data Procedures:
  - 1. Submit only information required by individual specification sections.
  - 2. Collect required information into a single submittal.
  - 3. Submit concurrently with related shop drawing submittal.
  - 4. Do not submit (Material) Safety Data Sheets for materials or products.
- C. Shop Drawing Procedures:
  - 1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
  - 2. Do not reproduce Contract Documents to create shop drawings.
  - 3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.
- D. Samples Procedures:
  - 1. Transmit related items together as single package.
  - 2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.

### 3.13 SUBMITTAL REVIEW

- A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.
- B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.
- C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.
  - 1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.
- D. Architect's and consultants' actions on items submitted for review:
  - 1. Authorizing purchasing, fabrication, delivery, and installation:

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Requirements

- a. "Approved", or language with same legal meaning.
    - b. "Approved as Noted, Resubmission not required", or language with same legal meaning.
    - c. "Approved as Noted, Resubmit for Record", or language with same legal meaning.
  - 2. Not Authorizing fabrication, delivery, and installation:
- E. Architect's and consultants' actions on items submitted for information:
- 1. Items for which no action was taken:
    - a. "Received" - to notify the Contractor that the submittal has been received for record only.
  - 2. Items for which action was taken:
    - a. "Reviewed" - no further action is required from Contractor.

**END OF SECTION**

**SECTION 01 3216  
CONSTRUCTION PROGRESS SCHEDULE**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Preliminary schedule.
- B. Construction progress schedule, CPM type.

**1.02 RELATED SECTIONS**

- A. Section 01 1000 - Summary: Work sequence.

**1.03 SUBMITTALS**

- A. Within 10 days after date of Agreement, submit preliminary schedule.
- B. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
  - 1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- C. Within 10 days after joint review, submit complete schedule.
- D. Submit updated schedule with each Application for Payment.

**1.04 QUALITY ASSURANCE**

- A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with one years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 PRELIMINARY SCHEDULE**

- A. Prepare preliminary schedule in the form of a CPM.

**3.02 CONTENT**

- A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
- B. Identify each item by specification section number.
- C. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.
- D. Provide legend for symbols and abbreviations used.

**3.03 CPM CHARTS**

- A. Include a separate bar for each major portion of Work or operation.
- B. Clearly identify bars that are part of the critical path.
- C. Identify the first work day of each week.

**3.04 REVIEW AND EVALUATION OF SCHEDULE**

- A. Participate in joint review and evaluation of schedule with Architect at each submittal.
- B. Evaluate project status to determine work behind schedule and work ahead of schedule.
- C. After review, revise as necessary as result of review, and resubmit within 10 days.

**3.05 UPDATING SCHEDULE**

- A. Maintain schedules to record actual start and finish dates of completed activities.

01 3216 Construction Progress  
Schedule

- B. Indicate progress of each activity to date of revision, with projected completion date of each activity.
- C. Annotate diagrams to graphically depict current status of Work.
- D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
- E. Indicate changes required to maintain Date of Final Completion.
- F. Submit reports required to support recommended changes.

**3.06 DISTRIBUTION OF SCHEDULE**

- A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.
- B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

**END OF SECTION**

**SECTION 01 4000  
QUALITY REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Submittals.
- B. Quality assurance.
- C. References and standards.
- D. Testing and inspection agencies and services.
- E. Contractor's design-related professional design services.
- F. Control of installation.
- G. Mock-ups.
- H. Tolerances.
- I. Manufacturers' field services.
- J. Defect Assessment.

**1.02 REFERENCE STANDARDS**

**1.03 DEFINITIONS**

- A. Design Data: Design-related, signed and sealed drawings, calculations, specifications, certifications, shop drawings and other submittals provided by Contractor, and prepared directly by, or under direct supervision of, appropriately licensed design professional.

**1.04 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES**

- A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.
- B. Base design on performance and/or design criteria indicated in individual specification sections.
- C. Scope of Contractor's Professional Design Services: Provide for the following items of work:
  - 1. Structural Design of Metal Framing: As described in Section 05 4000 - Cold-Formed Metal Framing.
  - 2. Structural Design: Include physical characteristics, engineering calculations, and resulting dimensional limitations as described in Section 08 4313 - Aluminum-Framed Storefronts.
  - 3. Sprinkler Layout: Coordinate with ceiling installation, detailed pipe layout, and hydraulic calculations as described in Section 21 1313 - Wet-Pipe Sprinkler Systems.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
- C. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
  - 1. Include:
    - a. Date issued.
    - b. Project title and number.
    - c. Name of inspector.
    - d. Date and time of sampling or inspection.
    - e. Identification of product and specifications section.
    - f. Location in the Project.
    - g. Type of test/inspection.
    - h. Date of test/inspection.

- i. Results of test/inspection.
  - j. Compliance with Contract Documents.
  - k. When requested by Architect, provide interpretation of results.
- 2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
- D. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
  - 1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
  - 2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.
- E. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

#### **1.06 QUALITY ASSURANCE**

- A. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

#### **1.07 TESTING AND INSPECTION AGENCIES AND SERVICES**

- A. Owner will employ and pay for services of an independent testing agency to perform specified testing.
- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

### **PART 3 EXECUTION**

#### **2.01 CONTROL OF INSTALLATION**

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

#### **2.02 MOCK-UPS**

- A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.
- B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.

- C. Notify Architect fifteen (15) working days in advance of dates and times when mock-ups will be constructed.
- D. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.
- E. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.
- F. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- G. Architect will use accepted mock-ups as a comparison standard for the remaining Work.
- H. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

### **2.03 TOLERANCES**

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

### **2.04 TESTING AND INSPECTION**

- A. Testing Agency Duties:
  - 1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
  - 2. Perform specified sampling and testing of products in accordance with specified standards.
  - 3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
  - 4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
  - 5. Perform additional tests and inspections required by Architect.
  - 6. Submit reports of all tests/inspections specified.
- B. Limits on Testing/Inspection Agency Authority:
  - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
  - 2. Agency may not approve or accept any portion of the Work.
  - 3. Agency may not assume any duties of Contractor.
  - 4. Agency has no authority to stop the Work.
- C. Contractor Responsibilities:
  - 1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
  - 2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
  - 3. Provide incidental labor and facilities:
    - a. To provide access to Work to be tested/inspected.
    - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
    - c. To facilitate tests/inspections.
    - d. To provide storage and curing of test samples.
  - 4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
  - 5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

- 6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- D. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.
- E. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

#### **2.05 MANUFACTURERS' FIELD SERVICES**

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

#### **2.06 DEFECT ASSESSMENT**

- A. Replace Work or portions of the Work not complying with specified requirements.
- B. If, in the opinion of Architect, it is not practical to remove and replace the work, Architect will direct an appropriate remedy or adjust payment.

**END OF SECTION**



**SECTION 014533  
SPECIAL INSPECTIONS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary General Conditions and other Division I Specification Sections, apply to this Section.

**1.2 GENERAL REQUIREMENTS**

- A. Special Inspections and Structural Testing shall be in accordance with Chapter 17 of the 2018 North Carolina State Building Code.
- B. The program of Special Inspection and Structural Testing is a Quality Assurance program intended to ensure that the work is performed in accordance with the Contract Documents
- C. This specification section is intended to inform the Contractor of the Owner's quality assurance program and the extent of the Contractor's responsibilities. This specification section is also intended to notify the Special Inspector, Testing Company/Testing Laboratory, and other Agents of the Special Inspector of their requirements and responsibilities.

**1.3 SCHEDULE OF INSPECTIONS AND TESTS**

- A. Required inspections and tests are described in the attached Schedule of Special Inspections and in the individual Specification Sections for the items to be inspected or tested.

**1.4 QUALIFICATIONS**

- A. The Special Inspector shall be a licensed Professional Engineer who is approved by the Structural Engineer of Record (SER) and Building Official.
- B. The Testing Company/Testing Laboratory and individual technicians shall be approved by the Structural Engineer of Record (SER) and Building Official.
- C. The Testing Company/Testing Laboratory shall retain a full-time licensed Professional Engineer on staff who shall certify all test reports. The Engineer shall be responsible for the training of the testing technicians and shall be in responsible charge of the field and laboratory testing operations.
  - 1. Special Inspections of soils and foundations may be performed by inspectors with an education and background in geotechnical engineering in lieu of a background in structural engineering.
  - 2. Technicians performing sampling and testing of concrete shall be ACI certified Concrete Field Testing Technicians-Grade 1.
  - 3. Inspectors performing inspections of concrete work such as inspections of concrete placement, batching, reinforcing placement, curing and protection, may be ACI certified Concrete Construction Inspectors or ICBO certified Reinforced Concrete Special Inspector in lieu of being a licensed P.E. or EIT.

4. Inspectors performing inspections of masonry may be ICBO certified Structural Masonry Special Inspector.
5. Technicians performing visual inspection of welding shall be AWS Certified Welding Inspectors or ICBO certified Structural Steel and Welding Special Inspectors, technicians performing non-destructive testing such as ultrasonic testing, radiographic testing, magnetic particle testing, or dye-penetrant testing shall be certified as an ASNT-TC Level II or Level III technician.
6. Inspectors performing inspections of spray fireproofing may be ICBO certified Spray-Applied Fireproofing Special Inspector.
7. Technicians performing standard tests described by specific ASTM Standards shall have training in the performance of such tests and must be able to demonstrate either by oral or written examination competence for the test to be conducted. They shall be under the supervision of a licensed Professional Engineer and shall not be permitted to independently evaluate test results.

#### 1.5 SUBMITTALS

- A. The Special Inspector and Testing Company/Testing Laboratory shall submit to the SER and Building Official for review a copy of their qualifications which shall include the names and qualifications of each of the individual inspectors and technicians who will be performing inspections or tests.
- B. The Special Inspector and Testing Company/Testing Laboratory shall disclose any past or present business relationship or potential conflict of interest with the Contractor or any of the Subcontractors whose work will be inspected or tested.

#### 1.6 PAYMENT

- A. The Owner shall engage and pay for the services of the Special Inspector, Agents of the Special Inspector or Testing Company/Testing Laboratory.
- B. If any materials which require Special Inspections are fabricated in a plant that is not certified and is not located within 150 miles of the project, the Contractor shall be responsible for the travel expenses of the Special Inspector of Testing Company/Testing Laboratory.
- C. The Contractor shall be responsible for the cost of any retesting or reinspection of work which fails to comply with the requirements of the Contract Documents.

#### 1.7 CONTRACTOR RESPONSIBILITIES

- A. The Contractor shall cooperate with the Special Inspector and his agents so that the Special Inspections and testing may be performed without hindrance.
- B. The Contractor shall review the Statement of Special Inspections and shall be responsible for coordinating and scheduling inspections and tests. The Contractor shall notify the Structural Engineer of Record, Special Inspector or Testing Company/Testing Laboratory at least 48 hours in advance of a required inspection or test. Uninspected work that required inspection may be rejected solely on that basis.

- C. The Contractor shall provide the form for the Final Report of Special Inspections to the Special Inspector for completion at the completion of the project.
- D. The Statement of Special Inspections will be completed by the Structural Engineer of Record and the Owner and provided to the Contractor after the contracts are signed and returned to the Owner. The Contractor shall submit the completed Statement of Special Inspections to the Building Official for acceptance at the time the building permit is applied for.
- E. The Contractor shall provide incidental labor and facilities to provide access to the work to be inspected or tested, to obtain and handle samples at the site or at source of products to be tested, to facilitate tests and inspections, storage and curing of test samples.
- F. The Contractor shall keep at the project site the latest set of construction drawings, field sketches, approved shop drawings, and specifications for use by the inspectors and testing technicians.
- G. The Special Inspection program shall in no way relieve the Contractor of his obligation to perform work in accordance with the requirements of the Contract Documents or from implementing an effective Quality Control program. All work that is to be subjected to Special Inspections shall first be reviewed by the Contractor's quality control personnel.
- H. The Contractor shall be solely responsible for construction site safety.

#### 1.8 LIMITS ON AUTHORITY

- A. The Special Inspector or Testing Company/Testing Laboratory may not release, revoke, alter, or enlarge on the requirements of the Contract Documents.
- B. The Special Inspector or Testing Company/Testing Laboratory will not have control over the Contractor's means or methods of construction.
- C. The Special Inspector or Testing Company/Testing Laboratory shall not be responsible for construction site safety.
- D. The Special Inspector or Testing Company/Testing Laboratory has no authority to stop the work.

#### 1.9 STATEMENT OF SPECIAL INSPECTIONS

- A. The Statement of Special Inspections will be prepared by the Structural Engineer of Record.
- B. The attached Statement of Special Inspections shall be used.
- C. The Statement of Special Inspections shall be provided to the Contractor after the contracts are signed and returned to the Owner and shall be submitted with the application of Building Permit.

#### 1.10 RECORDS AND REPORTS

- A. Detailed daily reports shall be prepared of each inspection or test and submitted to the Special Inspector. Reports shall include:
  - 1. date of test or inspection
  - 2. name of inspector or technician
  - 3. location of specific areas tested or inspected
  - 4. description of test or inspection and results
  - 5. applicable ASTM standard
  - 6. weather conditions
  - 7. Engineer's seal and signature
- B. The Special Inspector shall submit interim reports to the Building Official at the end of each month which include all inspections and test reports received last week. Copies shall be sent to the SER, Architect and Contractor.
- C. Any discrepancies from the Contract Documents found during a Special Inspection shall be immediately reported to the Contractor. If the discrepancies are not corrected, the Special Inspector shall notify the SER and Building Official. Reports shall document all discrepancies identified and the correction action taken.
- D. The Testing Company/Testing Laboratory shall immediately notify the Special Inspector and the SER by telephone, fax or electronic mail any test results which fail to comply with the requirements of the Contract Documents.
- E. Reports shall be submitted to the Special Inspector within 7 days of the inspection or test. Legible hand written reports may be submitted if final typed copies are not readily available. Formal reports shall follow.
- F. At the completion of the work requiring Special Inspections, each inspection agency and Testing Company/Testing Laboratory shall provide a statement to the Special Inspector that all work was completed in substantial conformance with the Contract Documents and that all appropriate inspections and tests were performed.

#### 1.11 FINAL REPORT OF SPECIAL INSPECTIONS

- A. The Final Report of Special Inspections shall be completed by the Special Inspector and submitted to the SER and Building Official prior to the issuance of a Certificate of Use and Occupancy.
- B. The attached Final Report of Special Inspections shall be used.
- C. The Final Report of Special Inspections will certify that all required inspections have performed and will itemize any discrepancies that were not corrected or resolved.

PART 2 - PRODUCTS (not applicable)

PART 3 - EXECUTION (not applicable)

Attached are the following forms:

1. Statement of Special Inspections
2. Schedule of Special Inspection Services
3. Quality Assurance Plan
4. Qualifications of Inspectors and Testing Technicians
5. Schedule of Special Inspection Services
6. Final Report of Special Inspections
7. Final Report of Special Inspections (Agent's Final Report)
8. Contractor's Statement of Responsibility
9. Fabricator's Certificate of Compliance

## **Statement of Special Inspections**

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Project: Brunswick Community College Public Safety Training Facility

22-25751-02A

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SPECIAL INSPECTIONS


Brunswick Community College

Alan Holden Public Safety Center

# 01 4533 Special Inspections

Location: Bolivia, NC  
 Owner's Representative:  
 Owner's Address:

This Statement of Special Inspections is submitted as a condition for permit issuance in accordance with the Special Inspection requirements of the 2018 North Carolina State Building Code. It includes a Schedule of Special Inspection Services applicable to this project, the name of the Special Inspector, the identity of other approved agencies retained for conducting Special Inspections, and the required inspector qualifications. This Statement of Special Inspections was prepared by the following Designers of Record:

Structural	Adam L Sisk		10/16/2024
	(Type or print name)	(Signature)	(Date)
Architectural			
	(Type or print name)	(Signature)	(Date)
Mechanical			
	(Type or print name)	(Signature)	(Date)
Other			
	(Type or print name)	(Signature)	(Date)

The Special Inspector shall keep records of all special inspections and tests and shall furnish reports to the State Construction Office and the Designers of Record. Reports shall indicate if the work inspected or tested was or was not completed in conformance with the approved construction documents. Discovered discrepancies shall be brought to the immediate attention of the Contractor for correction. If such discrepancies are not corrected, the discrepancies shall be brought to the attention of the State Construction Office and the Designers of Record. The Special Inspections program does not relieve the Contractor of his or her responsibilities.

Interim reports shall be submitted to the State Construction Office, Owner, and the Designers of Record.

Interim Report Frequency: Monthly

A Final Report of Special Inspections documenting completion of all required Special Inspections, testing, and correction of any discrepancies should be submitted prior to issuance of a Certificate of Use and Occupancy.

Job Site safety and means and methods of construction are solely the responsibility of the Contractor.

Owner's Authorization

Accepted by Brunswick County:

Signature \_\_\_\_\_ Date \_\_\_\_\_

Signature \_\_\_\_\_ Date \_\_\_\_\_

## Schedule of Special Inspection Services

The following sheets comprise the required schedule of special inspections for this project. The construction divisions which require special inspections for this project are as follows.

☒ Structural Steel & High Strength Bolting ☐ Helical Pile Foundations

22-25751-02A

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SPECIAL INSPECTIONS

Brunswick Community College  
 Alan Holden Public Safety Center

# 01 4533 Special Inspections

- |   |  |
|---|--|
| <input checked="" type="checkbox"/> Welding of Structural Steel           | <input type="checkbox"/> Rammed Aggregate Piers & Stone Columns                  |
| <input checked="" type="checkbox"/> Cold-Formed Steel Deck                | <input type="checkbox"/> Sprayed Fire-Resistant Material                         |
| <input checked="" type="checkbox"/> Open-Web Steel Joists & Joist Girders | <input checked="" type="checkbox"/> Mastic & Intumescent Fire-Resistant Coatings |
| <input checked="" type="checkbox"/> Cold-Formed Steel Framing             | <input type="checkbox"/> Exterior Insulation & Finish System                     |
| <input checked="" type="checkbox"/> Concrete Construction                 | <input checked="" type="checkbox"/> Fire-Resistant Penetrations & Joints         |
| <input checked="" type="checkbox"/> Masonry Construction                  | <input type="checkbox"/> Smoke Control   |
| <input type="checkbox"/> Wood Construction                                | <input type="checkbox"/> Retaining Wall & Systems > 5 Feet                       |
| <input checked="" type="checkbox"/> Soils                                 | <input checked="" type="checkbox"/> Special Inspections for Wind Resistance      |
| <input type="checkbox"/> Driven Deep Foundations                          | <input type="checkbox"/> Special Inspections for Seismic Resistance              |
| <input type="checkbox"/> Cast-in-Place Deep Foundations                   |  |

The inspection frequency indicated on the following inspection tables are "C" continuous, "P" periodic, & "O" random on a daily basis.

Inspection Agents	Firm Name & Point of Contact	Address / Phone / E-mail
1. Special Inspector (SI-1)		
2. Testing Agency (TA-1)		
3. Testing Agency (TA-2)		
4. Geotechnical Engineer (GE-1)		
5. Other (O-1)		

Note: The inspection and testing agent(s) shall be engaged by the Owner or the Registered Design Professional of Record acting as the Owner's agent, and not by the Contractor or Subcontractor whose work is to be inspected or tested. Any conflict of interest must be disclosed to the State Construction Office, prior to commencing work.

Seismic Design Category: ☐ A ☒ B ☐ C ☐ D

Basic Wind Speed ( $V_{asd}$ ): ☐ 90-109mph ☐ 110-119mph ☒ ≥120mph

Wind Exposure Category: ☐ B ☒ C ☐ D

Schedule of Special Inspection Services  
**Structural Steel and High-Strength Bolting**

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agent
			AISC 360	NCBC	
1. Fabricator Certification / Verification of Quality Control Procedures					
a. Verify fabricator qualifications	<input checked="" type="checkbox"/>	C		1704.2.5.1	
b. Review material test reports & certifications	<input checked="" type="checkbox"/>	C	N5.2		
c. Collect certificates of compliance from the steel fabricator at completion of fabrication	<input checked="" type="checkbox"/>	C		1704.5	
2. Inspections Prior to High-Strength Bolting at Pretensioned and Slip-Critical Joints					
a. Collect manufacturer's certifications for fastener materials	<input checked="" type="checkbox"/>	C	Table (Tbl) N5.6-1		
b. Fasteners are marked per ASTM requirements	<input checked="" type="checkbox"/>	P	Tbl N5.6-1		
c. Ensure correct fasteners and bolting procedures are selected for joint details	<input checked="" type="checkbox"/>	P	Tbl N5.6-1		
d. Verify connecting elements, including the appropriate faying surface condition and hole preparation when specified, comply with the construction documents	<input checked="" type="checkbox"/>	P	Tbl N5.6-1		
e. Observe and document pre-installation verification testing by installation personal for fastener assemblies and methods	<input checked="" type="checkbox"/>	P	Tbl N5.6-1		
f. Verify proper storage provided for all fastener components	<input checked="" type="checkbox"/>	P	Tbl N5.6-1		
3. Inspections During High-Strength Bolting at Pretensioned and Slip-Critical Joints					
a. Ensure correct fastener assemblies placed in all holes and washers, when specified, are positioned as required	<input checked="" type="checkbox"/>	P	Tbl N5.6-2		
b. Verify joint brought to snug-tight condition prior to pretensioning	<input checked="" type="checkbox"/>	P	Tbl N5.6-2		
c. Verify fastener components not turned by the wrench prevented from rotating	<input checked="" type="checkbox"/>	P	Tbl N5.6-2		
d. Ensure fasteners are pretensioned in accordance with RCSC, progressing from the most rigid point towards free edges	<input checked="" type="checkbox"/>	P	Tbl N5.6-2		
4. Document acceptance or rejection of bolted connections after high-strength bolting is complete	<input checked="" type="checkbox"/>	C	Tbl N5.6-3		
5. Structural Details					
a. Verify diameter, grade, type and length of anchor rods and other embedded items supporting structural steel	<input checked="" type="checkbox"/>	P	N5.7		
b. Inspection of fabricated assemblies & erected steel framing verifying compliance with the construction documents	<input checked="" type="checkbox"/>	P	N5.7		



Schedule of Special Inspection Services  
**Welding of Structural Steel**

Inspection Task	Task Req'd	Freq	Code Reference		Agent
			AISC 360	NCBC	
1. Inspections Prior to Welding			N5.4		
a. Collect & review welding procedure specification (WPS) and verify manufacturer certifications for welding consumables	<input checked="" type="checkbox"/>	C	Table (Tbl) N5.4-1		
b. Confirm weld material type & grade	<input checked="" type="checkbox"/>	P	Tbl N5.4-1		
c. Confirm method of welder identification	<input checked="" type="checkbox"/>	P	Tbl N5.4-1		
d. Inspection of fit-up for groove & fillet welds including access hole configuration & finish	<input checked="" type="checkbox"/>	P	Tbl N5.4-1		
2. Inspections During Welding			N5.4		
a. Verify welder qualifications	<input checked="" type="checkbox"/>	P	Tbl N5.4-2		
b. Verify proper control and handling of welding consumables	<input checked="" type="checkbox"/>	P	Tbl N5.4-2		
c. Monitor environmental conditions	<input checked="" type="checkbox"/>	P	Tbl N5.4-2		
d. Monitor proper implementation of WPS	<input checked="" type="checkbox"/>	P	Tbl N5.4-2		
e. Inspection of welding techniques including no welding over cracked tack welds	<input checked="" type="checkbox"/>	P	Tbl N5.4-2		
3. Inspections After Welding			N5.4, N5.5		
a. Verify welds have been cleaned	<input checked="" type="checkbox"/>	P	Tbl N5.4-3		
b. Confirm the installed size, length and location of welds matches the contract documents	<input checked="" type="checkbox"/>	C	Tbl N5.4-3		
c. Verify welds meet visual acceptance criteria	<input checked="" type="checkbox"/>	C	Tbl N5.4-3		
d. Confirm arc strikes comply with Part 5.28 of AWS D1.1	<input checked="" type="checkbox"/>	C	Tbl N5.4-3		
e. Visually observe web k-area for cracks within 3" of welded doubler plates, continuity plates and stiffeners	<input checked="" type="checkbox"/>	C	Tbl N5.4-3		
f. Backing and weld tabs removed per contract documents	<input checked="" type="checkbox"/>	C	Tbl N5.4-3		
g. Observe and inspect weld repair activities	<input checked="" type="checkbox"/>	C	Tbl N5.4-3		
h. For Risk Category III or IV structures, conduct ultrasonic testing (UT) of CJP groove welds in materials $\geq 5/16"$ at butt, T- and corner joints subject to transversely applied tension loading	<input checked="" type="checkbox"/>	C	N.5.5b, N5.5e		
i. For Risk Category II structures, conduct ultrasonic testing (UT) of CJP groove welds in materials $\geq 5/16"$ at butt, T- and corner joints subject to transversely applied tension loading	<input checked="" type="checkbox"/>	P	N.5.5b, N5.5f		
j. Conduct magnetic particle testing (MT) or liquid penetrant testing (PT) at thermally cut surfaces of access holes for rolled section with $t_f > 2"$ and built-up shape with $t_w > 2"$	<input checked="" type="checkbox"/>	C	N5.5c		
k. Radiographic or ultrasonic inspection at joints subject to fatigue	<input checked="" type="checkbox"/>	C	N5.5d, Tbl A-3.1		
l. Document acceptance / rejection of welded joints and members	<input checked="" type="checkbox"/>	C	Tbl N5.4-3, N5.5g		

Schedule of Special Inspection Services  
**Cold-Formed Steel Deck**

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agent
			SDI QA/QC	NCBC	
1. Prior to deck placement, verify deck and deck accessories comply with the construction documents	<input checked="" type="checkbox"/>	C	Table (Tbl) 1.1		
2. Inspection Tasks After Deck Placement					
a. Verify the installation of deck & deck accessories complies with the construction documents	<input checked="" type="checkbox"/>	C	Tbl 1.2		
b. Verify that deck materials' mill certifications comply with the construction documents	<input checked="" type="checkbox"/>	C	Tbl 1.2		
3. Inspection Tasks Prior to Deck Welding					
a. Collect welding procedure specification (WPS)	<input checked="" type="checkbox"/>	P	Tbl 1.3		
b. Collect manufacturer certifications for welding consumables	<input checked="" type="checkbox"/>	P	Tbl 1.3		
c. Verify material type and grade	<input checked="" type="checkbox"/>	P	Tbl 1.3		
d. Check welding equipment	<input checked="" type="checkbox"/>	P	Tbl 1.3		
4. Inspection Tasks During Deck Welding					
a. Verify welder qualifications	<input checked="" type="checkbox"/>	P	Tbl 1.4		
b. Verify proper control and handling of welding consumables	<input checked="" type="checkbox"/>	P	Tbl 1.4		
c. Monitor environmental conditions	<input checked="" type="checkbox"/>	P	Tbl 1.4		
d. Monitor proper implementation of WPS	<input checked="" type="checkbox"/>	P	Tbl 1.4		
5. Inspection Tasks After Welding					
a. Verify size and location of welds, including support, sidelap and perimeter welds	<input checked="" type="checkbox"/>	C	Tbl 1.5		
b. Verify welds meet visual acceptance criteria	<input checked="" type="checkbox"/>	C	Tbl 1.5		
c. Observe weld repair activities	<input checked="" type="checkbox"/>	C	Tbl 1.5		
6. Inspection Tasks Prior to Mechanical Fastening					
a. Verify manufacturer installation instructions available for mechanical fasteners	<input checked="" type="checkbox"/>	P	Tbl 1.6		
b. Proper tools available for fastener installation	<input checked="" type="checkbox"/>	P	Tbl 1.6		
c. Verify proper storage of mechanical fasteners	<input checked="" type="checkbox"/>	P	Tbl 1.6		
7. Inspection Tasks During Mechanical Fastening					
a. Observe fastener spacing and position	<input checked="" type="checkbox"/>	P	Tbl 1.7		
b. Verify fasteners are installed in accordance with manufacturer's instructions	<input checked="" type="checkbox"/>	P	Tbl 1.7		
8. Inspection Tasks After Mechanical Fastening					
a. Check spacing, type and installation of support fasteners	<input checked="" type="checkbox"/>	C	Tbl 1.8		
b. Check spacing, type, and installation of sidelap fasteners	<input checked="" type="checkbox"/>	C	Tbl 1.8		
c. Check spacing, type, and installation of perimeter fasteners	<input checked="" type="checkbox"/>	C	Tbl 1.8		
d. Verify repair activities	<input checked="" type="checkbox"/>	C	Tbl 1.8		
9. Document acceptance or rejection of deck & deck accessories for all phases of construction	<input checked="" type="checkbox"/>	C	Tbls 1.1 thru 1.8		

Schedule of Special Inspection Services  
**Open-Web Steel Joists and Joist Girders**

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agent
			Standard	NCBC	
1. Fabricator Certification / Verification of Quality Control Procedures					
a. Verify fabricator qualifications	<input checked="" type="checkbox"/>	C		1704.2.5.1	
b. Collect certificate of compliance from steel joist producer at completion of manufacture	<input checked="" type="checkbox"/>	C		1704.5, 2207.5	
2. Observe bolted and welded joist end connections	<input checked="" type="checkbox"/>	P	SJI-K 5.3, 5.6, SJI-LH/DLH 104.4, 104.7, SJI-JG 1004.4, 1004.6, SJI-CJ 104.4, 104.7	Table (Tbl) 1705.2.3	
3. Verify size, spacing and connection of standard horizontal and diagonal bridging	<input checked="" type="checkbox"/>	P	SJI-K 5.4, SJI-LH/DLH 104.5, SJI-JG 1004.5, 1004.9, SJI-CJ 104.5	Tbl 1705.2.3	
4. Verify size, spacing and connection of bridging that differs from the SJI specifications listed by Part 2207.1 of the NCBC	<input checked="" type="checkbox"/>	P		Tbl 1705.2.3	

Schedule of Special Inspection Services  
**Cold-Formed Steel Framing**

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agent
			Standard	NCBC	
1. Fabricator Certification / Verification of Quality Control Procedures					
a. Verify fabricator qualifications	☒	C		1704.2.5.1	
b. Collect certificates of compliance from the steel fabricator at completion of fabrication	☒	C		1704.5	

Schedule of Special Inspection Services  
**Concrete Construction**

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agent
			Standard <sup>a</sup>	NCBC	
1. Inspect reinforcement and verify placement	<input checked="" type="checkbox"/>	P	ACI Ch.20, 25.2, 25.3, 26.6.1-26.6.3	1908.4	
2. Reinforcing Bar Welding:			AWS D1.4		
e. Verify weldability of reinforcing bars other than ASTM A706 and collect reports	<input checked="" type="checkbox"/>	P	ACI 26.6.4	1704.5	
f. Inspect single-pass fillet welds $\leq 5/16"$	<input checked="" type="checkbox"/>	P	ACI 26.6.4		
g. Inspect all welds other than single-pass fillet welds $\leq 5/16"$	<input checked="" type="checkbox"/>	C	ACI 26.6.4		
3. Concrete Anchors:					
a. Inspect anchors cast in concrete	<input checked="" type="checkbox"/>	P	ACI 17.8.2		
b. Inspect adhesive anchors installed in hardened concrete with horizontally or upwardly inclined orientations that resist sustained tension loads	<input checked="" type="checkbox"/>	C	ACI 17.8.2.4		
c. Inspect adhesive anchors installed in hardened concrete with orientations different from Item 3.b	<input checked="" type="checkbox"/>	P	ACI 17.8.2		
d. Inspect mechanical anchors installed in hardened concrete	<input checked="" type="checkbox"/>	P	ACI 17.8.2		
4. Collect mix designs and verify the correct mix used during installation	<input checked="" type="checkbox"/>	P	ACI Ch19, 26.4.3, 26.4.4	1904.1, 1904.2, 1908.2, 1908.3	
5. Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete	<input checked="" type="checkbox"/>	C	ASTM C172, ASTM C31, ACI 26.4, 26.12	1908.10	
6. Inspect concrete placement for proper application techniques	<input checked="" type="checkbox"/>	C	ACI 26.5	1908.6, 1908.7, 1908.8	
7. Verify maintenance of specified curing temperature and techniques	<input checked="" type="checkbox"/>	P	ACI 26.5.3-26.5.5	1908.9	
8. Inspect formwork for shape, location and dimensions of the concrete member being formed	<input checked="" type="checkbox"/>	P	ACI 26.11.1.2(b)		
9. Collect mill test reports for ASTM A615 rebar used by SFRS special moment frames, special structural walls or coupling beams	<input checked="" type="checkbox"/>	C	ACI 20.2.2.5	1704.5	

a. References to "ACI" in this table are to the ACI 318-14.

## Schedule of Special Inspection Services

### Masonry – Level B

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agent
			TMS 402 <sub>a</sub>	TMS 602 <sub>a</sub>	
1. Test & verify slump flow & visual stability index as delivered to site for self-consolidating grout	<input checked="" type="checkbox"/>	C	Table (Tbl) 3.1.2	Art. 1.5B.1.b.3	
2. Test & verify f'm & f'AAC prior to construction	<input checked="" type="checkbox"/>	C	Tbl 3.1.2	Art. 1.4B	
3. Verify compliance with the approved submittals	<input checked="" type="checkbox"/>	P	Tbl 3.1.2	Art. 1.5	
4. As masonry construction begins, verify that the following are in compliance:					
a. Proportions of site-prepared mortar	<input checked="" type="checkbox"/>	P		Art. 2.1, 2.6A	
b. Construction of mortar joints	<input checked="" type="checkbox"/>	P		Art. 3.3B	
c. Grade and size of prestressing tendons and anchorages	<input type="checkbox"/>	P		Art. 2.4B, 2.4H	
d. Location of reinforcement, connectors and prestressing tendons and anchorages	<input checked="" type="checkbox"/>	P		Art. 3.4, 3.6A	
e. Prestressing technique	<input type="checkbox"/>	P		Art. 3.6B	
f. Properties of thin-bed mortar at AAC masonry	<input type="checkbox"/>	C / P <sub>a</sub>		Art. 2.1C	
5. Prior to grouting, verify that the following comply:					
a. Grout space is clean, and cleanouts provided when required	<input checked="" type="checkbox"/>	P		Art. 3.2D, 3.2F	
b. Grade, type & size of reinforcement & anchor bolts, & prestressing tendons & anchorage	<input checked="" type="checkbox"/>	P	Sec. 6.1	Art. 2.4, 3.4	
c. Placement of reinforcement, connectors, and prestressing tendons and anchorage	<input checked="" type="checkbox"/>	P	Sec. 6.1, 6.2.1, 6.2.6, 6.2.7	Art. 3.2E, 3.4, 3.6A	
d. Proportions of site-prepared grout and prestressing grout for bonded tendons	<input checked="" type="checkbox"/>	P		Art. 2.6B, 2.4G.1.b	
e. Construction and size of mortar joints	<input checked="" type="checkbox"/>	P		Art. 3.3B	
6. Verify during construction:					
a. Size and location of structural elements	<input checked="" type="checkbox"/>	P		Art. 3.3F	
b. Type, size, and location of anchors, including other details of anchorage of masonry to structural members, frames, or other construction	<input checked="" type="checkbox"/>	P	Sec. 1.2.1(e), 6.1.4.3, 6.2.1		
c. Welding of reinforcement	<input checked="" type="checkbox"/>	C	Sec. 8.1.6.7.2, 9.3.3.4(c), 11.3.3.4(b)		
d. Preparation, construction, and protection of masonry during cold weather (temperature < 40°F) or hot weather (temperature > 90°F)	<input checked="" type="checkbox"/>	P		Art. 1.8C, 1.8D	
e. Application & measurement of prestress force	<input type="checkbox"/>	C		Art. 3.6B	
f. Verify placement of grout and prestressing grout for bonded tendons	<input type="checkbox"/>	C		Art. 3.5, 3.6C	
g. Placement of AAC masonry units and construction of thin-bed mortar joints	<input type="checkbox"/>	C / P <sub>b</sub>		Art. 3.3B.9, 3.3F.1.b	
7. Observe preparation of grout specimens, mortar specimens, and or prisms	<input checked="" type="checkbox"/>	P		Art. 1.4.B.2.a.3, 1.4.B.2.b.3, 1.4.B.2.c.3, 1.4.B.3, 1.4.B.4	

a. References to "TMS402" in this table are to the TMS402/ACI530/ASCE5-13. References to "TMS602" are to TMS602/ACI530.1/ASCE6-13.

b. AAC masonry shall be continuously inspected for the first 5000-square feet and periodically inspected afterwards.

Schedule of Special Inspection Services  
**Soils**

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agents
			Standard	NCBC	
1. Verify materials below shallow foundations are adequate to achieve the design bearing capacity	<input checked="" type="checkbox"/>	P		1705.6	
2. Verify excavations extend to proper depth and have reached the correct soil material	<input checked="" type="checkbox"/>	P		1705.6	
3. Perform classification and testing of compacted fill materials	<input checked="" type="checkbox"/>	P		1705.6	
4. Verify that materials used, densities, lift thickness and procedures used during placement and compaction of compacted fill are in accordance with the approved soils report and the construction documents	<input checked="" type="checkbox"/>	C		1705.6	
5. Prior to placement of compacted fill, verify that the subgrade has been prepared in accordance with the approved soils report and the construction documents	<input checked="" type="checkbox"/>	P		1705.6	

Schedule of Special Inspection Services  
**Mastic and Intumescent Fire-Resistant Coatings**

Inspection Task	Task Req'd	Freq <sup>(a)</sup>	Reference for Criteria		Agents
			Standard	NCBC	
1. Prior to application, verify preparation of substrate and suitability of primers, if present, are in accordance with approved fire resistance design, approved manufacturer's written instructions, and the requirements of AWCI 12-B	<input type="checkbox"/>	P	AWCI 12-B	1705.15	
2. Observe the application of fire-resistant coatings ensuring compliance with approved fire resistance design, approved manufacturer's written instructions, and the requirements of AWCI 12-B	<input type="checkbox"/>	P	AWCI 12-B	1705.15	
3. After adequate drying but prior to the application of any topcoat, measure the final mastic / intumescent material thickness ensuring compliance with the construction documents and approved material / installation submittals. Measurements must consider the thickness of primers or other existing coatings on the surface of the substrate.	<input type="checkbox"/>	P	AWCI 12-B	1705.15	



**Fire-resistant Penetrations and Joints <sup>a</sup>**

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agent
			Standard	NCBC	
1. Inspect through-penetration firestop systems at fire walls, fire barriers, smoke barriers and fire partition walls in accordance with ASTM E2174	<input checked="" type="checkbox"/>	P		1705.17.1, 714.3.1.2	
2. Inspect penetration firestop systems at penetrations through membranes that are part of a horizontal assembly in accordance with ASTM E2174	<input checked="" type="checkbox"/>	P		1705.17.1, 714.4.2	
3. Inspect fire-resistant joint systems in accordance with ASTM 2393	<input checked="" type="checkbox"/>	P		1705.17.2, 715.3, 715.4	

a. The inspection of fire-resistant penetrations and joints applies only to high-rise buildings or buildings assigned to Risk Category III or IV.

Schedule of Special Inspection Services  
**Special Inspections for Wind Resistance**

Inspection Task	Task Req'd	Freq	Reference for Criteria		Agent
			Standard	NCBC	
1. Prior to any work taking place, each contractor responsible for the construction of a wind-resisting system or component shall submit a written statement of contractor responsibility	<input checked="" type="checkbox"/>	C		1704.4	
2. Structural Wood					
a. Verify field gluing operations pertinent to the main wind force-resisting system	<input type="checkbox"/>	C		1705.11.1	
b. Inspect nailing, anchoring, and fastening of components within the main windforce-resisting system including shear walls, diaphragms, drag struts, braces & hold-downs	<input type="checkbox"/>	P		1705.11.1	
3. Cold-Formed Steel Light Frame Construction					
a. Inspect welding operations at elements of the main windforce-resisting system	<input checked="" type="checkbox"/>	P		1705.11.2	
b. Inspect screw attachment, bolting, anchoring, and fastening of elements within the main windforce-resisting system including shear walls, braces, diaphragms collectors, drag struts and hold-downs	<input checked="" type="checkbox"/>	P		1705.11.2	
4. Wind-resisting components					
a. Inspect the fastening of roof covering, roof deck and supporting roof framing connections	<input checked="" type="checkbox"/>	P		1705.11.3.1	
b. Inspect the fastening of exterior wall coverings & the wall connections to the roof / floor diaphragms & framing members	<input checked="" type="checkbox"/>	P		1705.11.3.2	

Roof Cladding Components and Connections Subject to Special Inspections: Metal decking attachments to roof joist. Roofing attachments to metal decking

Wall Cladding Components and Connections Subject to Special Inspections: Sheathing attachments to stud framing.

## FINAL REPORT OF SPECIAL INSPECTIONS - STRUCTURAL

Project: Brunswick Community College Public Safety Training Facility

Location: Bolivia, NC

Owner: Brunswick Community College

Owner's Address: 50 College Road NE Bolivia, NC 28422

Architect of Record: Doug Sherwood, AIA

Structural Engineer of Record: Adam L. Sisk, PE

Comments:

Respectfully submitted,

\_\_\_\_\_  
Signature  
Professional Seal

Date

Licensed

## FINAL REPORT OF SPECIAL INSPECTIONS

### AGENT'S FINAL REPORT

Project: Brunswick Community College Public Safety Training Facility

Agent:

Special Inspector:

To the best of my information, knowledge and belief, the Special Inspections or testing required for this project, and designated for this Agent in the *Statement of Special Inspections* submitted for permit, have been performed and all discovered discrepancies have been reported and resolved other than the following:

Comments:

*(Attach continuation sheets if required to complete the description of corrections).*

Interim reports submitted prior to this final report form a basis for and are to be considered an integral part of this final report.

Respectfully submitted,

Agent of the Special Inspector

Seal

Licensed Professional

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

## FABRICATOR'S CERTIFICATE OF COMPLIANCE

Each approved fabricator that is exempt from Special Inspection of shop fabrication and implementation procedures per section 1704.2 of the International Building Code must submit a *Fabricator's Certificate of Compliance* at the completion of fabrication.

Project: Brunswick Community College Public Safety Training Facility

Fabricator's Name:

Address:

Certification or Approval Agency:

Certification Number:

Date of Last Audit or Approval:

Description of structural members and assemblies that have been fabricated:

I hereby certify that items described above were fabricated in strict accordance with the approved construction documents.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Title

Attach copies of fabricator's certification or building code evaluation service report and fabricator's quality control manual.

## CONTRACTOR'S STATEMENT OF RESPONSIBILITY

Each contractor responsible for the construction or fabrication of a system or component designated in the Quality Assurance Plan must submit a Statement of Responsibility.

Project: Brunswick Community College Public Safety Training Facility

Contractor's Name:

Address:

License No.:

Description of designated building systems and components included in the Statement of Responsibility:

### Contractor's Acknowledgment of Special Requirements

I hereby acknowledge that I have received, read, and understand the Quality Assurance Plan and Special Inspection program.

I hereby acknowledge that control will be exercised to obtain conformance with the construction documents approved by the Building Official.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

### Contractor's Provisions for Quality Control

Procedures for exercising control within the contractor's organization, the method and frequency of reporting and the distribution of reports is attached to this Statement.

Identification and qualifications of the person(s) exercising such control and their position(s) in the organization are attached to this Statement.

**SECTION 01 5000  
TEMPORARY FACILITIES AND CONTROLS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Temporary utilities.
- B. Temporary telecommunications services.
- C. Temporary sanitary facilities.
- D. Temporary Controls: Barriers, enclosures, and fencing.
- E. Security requirements.
- F. Vehicular access and parking.
- G. Waste removal facilities and services.
- H. Project identification sign.
- I. Field offices.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 5213 - Field Offices and Sheds.
- B. Section 01 5813 - Temporary Project Signage.

**1.03 TEMPORARY UTILITIES**

- A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.
- B. Use trigger-operated nozzles for water hoses, to avoid waste of water.

**1.04 TELECOMMUNICATIONS SERVICES**

- A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
- B. Telecommunications services shall include:
  - 1. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.
  - 2. Internet Connections: Minimum of one; DSL modem or faster.
  - 3. Email: Account/address reserved for project use.

**1.05 TEMPORARY SANITARY FACILITIES**

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Maintain daily in clean and sanitary condition.

**1.06 BARRIERS**

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations.
- B. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

**1.07 FENCING**

- A. Construction: Contractor's option.

**1.08 SECURITY**

- A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

**1.09 VEHICULAR ACCESS AND PARKING**

- A. Coordinate access and haul routes with governing authorities and Owner.

01 5000 Temporary Facilities and  
Controls

- B. Provide and maintain access to fire hydrants, free of obstructions.
- C. Provide means of removing mud from vehicle wheels before entering streets.
- D. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

**1.10 WASTE REMOVAL**

- A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- B. Provide containers with lids. Remove trash from site periodically.
- C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

**1.11 PROJECT SIGNS - SEE SECTION 01 5813**

**1.12 FIELD OFFICES - SEE SECTION 01 5213**

- A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.
- B. Provide space for Project meetings, with table and chairs to accommodate 8 persons.
- C. Locate offices a minimum distance of 30 feet from existing and new structures.

**1.13 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS**

- A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
- B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.
- C. Clean and repair damage caused by installation or use of temporary work.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**



**SECTION 01 5213  
FIELD OFFICES AND SHEDS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Temporary field offices for use of Contractor.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 1000 - Summary: use of premises and responsibility for providing field offices.
- B. Section 01 5000 - Temporary Facilities and Controls:
  - 1. Temporary telecommunications services for administrative purposes.
  - 2. Temporary sanitary facilities required by law.

**PART 2 PRODUCTS**

**2.01 MATERIALS, EQUIPMENT, FURNISHINGS**

- A. Materials, Equipment, Furnishings: Serviceable, new or used, adequate for required purpose.

**2.02 CONSTRUCTION**

- A. Portable or mobile buildings, or buildings constructed with floors raised above ground, securely fixed to foundations, with steps and landings at entrance doors.
- B. Construction: Structurally sound, secure, weather tight enclosures for office. Maintain during progress of Work; remove when no longer needed.
- C. Fire Extinguishers: Appropriate type fire extinguisher at each office.

**2.03 ENVIRONMENTAL CONTROL**

- A. Heating, Cooling, and Ventilating: Automatic equipment to maintain comfort conditions.

**2.04 CONTRACTOR OFFICE AND FACILITIES**

- A. Size: For Contractor's needs and to provide space for project meetings.
- B. Telephone: As specified in Section 01 5000.
- C. Furnishings in Meeting Area: Conference table and chairs to seat at least eight persons; racks and files for Contract Documents, submittals, and project record documents.

**2.05 OWNER AND ARCHITECT/ENGINEER OFFICE**

**PART 3 EXECUTION**

**3.01 PREPARATION**

- A. Fill and grade sites for temporary structures to provide drainage away from buildings.

**3.02 INSTALLATION**

- A. Install office spaces ready for occupancy 15 days after date fixed in Notice to Proceed.

**3.03 REMOVAL**

- A. At completion of Work remove buildings, foundations, utility services, and debris. Restore areas.

**END OF SECTION**

**SECTION 01 5813  
TEMPORARY PROJECT SIGNAGE**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Project identification sign.

**1.02 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawing: Show content, layout, lettering, color, foundation, structure, sizes and grades of members.

**PART 2 PRODUCTS**

**2.01 SIGN MATERIALS**

- A. Structure and Framing: New, wood, structurally adequate.
- B. Sign Surfaces: Exterior grade plywood with medium density overlay, minimum 3/4 inch thick, standard large sizes to minimize joints.
- C. Rough Hardware: Galvanized.
- D. Paint and Primers: Exterior quality, two coats; sign background of color as selected.

**2.02 PROJECT IDENTIFICATION SIGN**

- A. One painted sign of construction, design, and content indicated on drawings, location designated.
- B. Content:
  - 1. Project number, title, logo and name of Owner as indicated on Contract Documents.
  - 2. Names and titles of Architect and Consultants.
  - 3. Name of Prime Contractor and major Subcontractors.
- C. Graphic Design, Colors, Style of Lettering: Designated by Architect.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

- A. Install project identification sign within 30 days after date fixed by Notice to Proceed.
- B. Erect at designated location.
- C. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.
- D. Install sign surface plumb and level, with butt joints. Anchor securely.
- E. Paint exposed surfaces of sign, supports, and framing.

**3.02 MAINTENANCE**

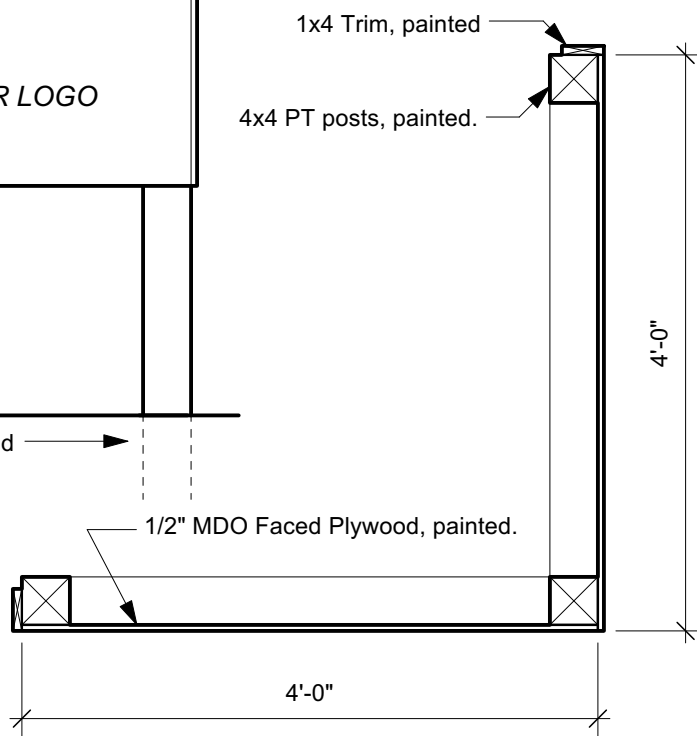
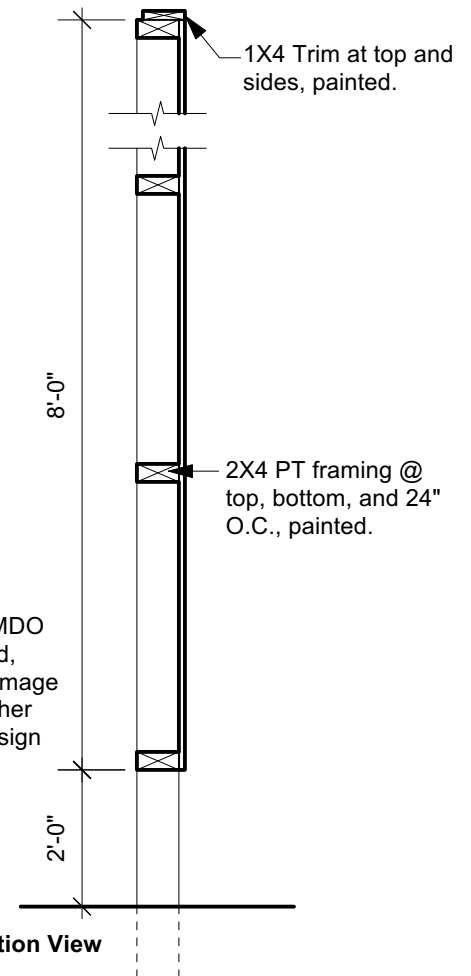
- A. Maintain signs and supports clean, repair deterioration and damage.

**3.03 REMOVAL**

- A. Remove signs, framing, supports, and foundations at completion of Project and restore the area.

**END OF SECTION**

**Temporary Project Sign**  
SCO #: 22-25751-02A  
BCC Alan Holden Public Safety Center



**SECTION 01 6000  
PRODUCT REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. General product requirements.
- B. Transportation, handling, storage and protection.
- C. Product option requirements.
- D. Substitution limitations.
- E. Procedures for Owner-supplied products.
- F. Maintenance materials, including extra materials, spare parts, tools, and software.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 2500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.

**1.03 SUBMITTALS**

- A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
  - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

**PART 2 PRODUCTS**

**2.01 NEW PRODUCTS**

- A. Provide new products unless specifically required or permitted by Contract Documents.
- B. Use of products having any of the following characteristics is not permitted:
  - 1. Containing lead, cadmium, or asbestos.
- C. Where other criteria are met, Contractor shall give preference to products that:
  - 1. If used on interior, have lower emissions, as defined in Section 01 6116.
  - 2. If wet-applied, have lower VOC content, as defined in Section 01 6116.
  - 3. Have a published GreenScreen Chemical Hazard Analysis.

**2.02 PRODUCT OPTIONS**

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

**2.03 MAINTENANCE MATERIALS**

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

## **PART 3 EXECUTION**

### **3.01 SUBSTITUTION LIMITATIONS**

- A. See Section 01 2500 - Substitution Procedures.

### **3.02 OWNER-SUPPLIED PRODUCTS**

- A. Owner's Responsibilities:
  - 1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
  - 2. Arrange and pay for product delivery to site.
  - 3. On delivery, inspect products jointly with Contractor.
  - 4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
  - 5. Arrange for manufacturers' warranties, inspections, and service.
- B. Contractor's Responsibilities:
  - 1. Review Owner reviewed shop drawings, product data, and samples.
  - 2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
  - 3. Handle, store, install and finish products.
  - 4. Repair or replace items damaged after receipt.

### **3.03 TRANSPORTATION AND HANDLING**

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

### **3.04 STORAGE AND PROTECTION**

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- G. Comply with manufacturer's warranty conditions, if any.

## 01 6000 Product Requirements

- H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- I. Prevent contact with material that may cause corrosion, discoloration, or staining.
- J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

**END OF SECTION**

**SECTION 01 7000  
EXECUTION AND CLOSEOUT REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Examination, preparation, and general installation procedures.
- B. Pre-installation meetings.
- C. Cutting and patching.
- D. Surveying for laying out the work.
- E. Cleaning and protection.
- F. Starting of systems and equipment.
- G. Demonstration and instruction of Owner personnel.
- H. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- I. General requirements for maintenance service.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 7900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections
- B. Section 07 8400 - Firestopping.

**1.03 REFERENCE STANDARDS**

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
  - 1. On request, submit documentation verifying accuracy of survey work.
  - 2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
  - 3. Submit surveys and survey logs for the project record.
- C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
  - 1. Structural integrity of any element of Project.
  - 2. Integrity of weather exposed or moisture resistant element.
  - 3. Efficiency, maintenance, or safety of any operational element.
  - 4. Visual qualities of sight exposed elements.
  - 5. Work of Owner or separate Contractor.
- D. Project Record Documents: Accurately record actual locations of capped and active utilities.

**1.05 QUALIFICATIONS**

- A. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

**1.06 PROJECT CONDITIONS**

- A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

01 7000 Execution and Closeout  
Requirements

- C. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- D. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
  - 1. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

**1.07 COORDINATION**

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Notify affected utility companies and comply with their requirements.
- C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean-up of work of separate sections.
- G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

**PART 2 PRODUCTS**

**2.01 PATCHING MATERIALS**

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.



### **3.02 PREPARATION**

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

### **3.03 PREINSTALLATION MEETINGS**

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Notify Architect four days in advance of meeting date.
- D. Prepare agenda and preside at meeting:
  - 1. Review conditions of examination, preparation and installation procedures.
  - 2. Review coordination with related work.
- E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

### **3.04 LAYING OUT THE WORK**

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Architect of any discrepancies discovered.
- C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
- F. Utilize recognized engineering survey practices.
- G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
  - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
  - 2. Grid or axis for structures.
  - 3. Building foundation, column locations, ground floor elevations.
- H. Periodically verify layouts by same means.
- I. Maintain a complete and accurate log of control and survey work as it progresses.

### **3.05 GENERAL INSTALLATION REQUIREMENTS**

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.

### **3.06 CUTTING AND PATCHING**

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. Perform whatever cutting and patching is necessary to:
  - 1. Complete the work.

01 7000 Execution and Closeout  
Requirements

2. Fit products together to integrate with other work.
  3. Provide openings for penetration of mechanical, electrical, and other services.
  4. Match work that has been cut to adjacent work.
  5. Repair areas adjacent to cuts to required condition.
  6. Repair new work damaged by subsequent work.
  7. Remove samples of installed work for testing when requested.
  8. Remove and replace defective and non-complying work.
- C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- D. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- F. Restore work with new products in accordance with requirements of Contract Documents.
- G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.
- I. Patching:
1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
  2. Match color, texture, and appearance.
  3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

**3.07 PROGRESS CLEANING**

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

**3.08 PROTECTION OF INSTALLED WORK**

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.
- G. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material

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manufacturer.

- H. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

**3.09 SYSTEM STARTUP**

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Architect and Owner seven days prior to start-up of each item.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify that wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

**3.10 DEMONSTRATION AND INSTRUCTION**

- A. See Section 01 7900 - Demonstration and Training.

**3.11 ADJUSTING**

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.
- B. Testing, adjusting, and balancing HVAC systems: See Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.

**3.12 FINAL CLEANING**

- A. Use cleaning materials that are nonhazardous.
- B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- E. Clean filters of operating equipment.
- F. Clean debris from roofs, scuppers, overflow drains, area drains, and drainage systems.
- G. Clean site; sweep paved areas, rake clean landscaped surfaces.
- H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

**3.13 CLOSEOUT PROCEDURES**

- A. Make submittals that are required by governing or other authorities.
- B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's comprehensive list of items to be completed or corrected.
- C. Notify Architect when work is considered ready for Architect's Final Completion inspection.
- D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in

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accordance with Contract Documents and ready for Architect's Final Completion inspection.

- E. Conduct Final Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.
- F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
- G. Notify Architect when work is considered finally complete and ready for Architect's Final Completion final inspection.
- H. Complete items of work determined by Architect listed in executed Certificate of Final Completion.

**3.14 MAINTENANCE**

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Final Completion or the length of the specified warranty, whichever is longer.
- C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

**END OF SECTION**

**SECTION 01 7800  
CLOSEOUT SUBMITTALS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Project record documents.
- B. Operation and maintenance data.
- C. Warranties and bonds.

**1.02 RELATED REQUIREMENTS**

- A. General and Supplementary General Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.
- B. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- C. Section 01 7000 - Execution and Closeout Requirements: Contract closeout procedures.
- D. Individual Product Sections: Specific requirements for operation and maintenance data.
- E. Individual Product Sections: Warranties required for specific products or Work.

**1.03 SUBMITTALS**

- A. Project Record Documents: Submit documents to Architect prior to claim for final Application for Payment.
- B. Operation and Maintenance Data:
  - 1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
  - 2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
  - 3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
  - 4. Submit two sets of revised final documents in final form within 10 days after final inspection.
- C. Warranties and Bonds:
  - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
  - 2. Make other submittals within 10 days after Date of Final Completion, prior to Final Application for Payment.
  - 3. For items of Work for which acceptance is delayed beyond Date of Final Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

**PART 3 EXECUTION**

**2.01 PROJECT RECORD DOCUMENTS**

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
  - 1. Drawings.
  - 2. Addenda.
  - 3. Change Orders and other modifications to the Contract.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Record Drawings: Legibly mark each item to record actual construction including:
  - 1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
3. Field changes of dimension and detail.
4. Details not on original Contract drawings.

## **2.02 OPERATION AND MAINTENANCE DATA**

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

## **2.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES**

- A. For Each Product, Applied Material, and Finish:
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

## **2.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS**

- A. For Each Item of Equipment and Each System:
  1. Description of unit or system, and component parts.
  2. Identify function, normal operating characteristics, and limiting conditions.
  3. Include performance curves, with engineering data and tests.
  4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
- D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- E. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- F. Provide servicing and lubrication schedule, and list of lubricants required.
- G. Include manufacturer's printed operation and maintenance instructions.
- H. Include sequence of operation by controls manufacturer.
- I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- J. Include test and balancing reports.

## **2.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS**

- A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.
- F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.
- I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- J. Arrangement of Contents: Organize each volume in parts as follows:
  - 1. Project Directory.
  - 2. Table of Contents, of all volumes, and of this volume.
  - 3. Operation and Maintenance Data: Arranged by system, then by product category.
    - a. Source data.
    - b. Operation and maintenance data.
    - c. Field quality control data.
    - d. Photocopies of warranties and bonds.

## **2.06 WARRANTIES AND BONDS**

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Final completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Include originals of each in operation and maintenance manuals, indexed separately on Table of Contents.

**END OF SECTION**

**SECTION 01 7900  
DEMONSTRATION AND TRAINING**

**PART 1 GENERAL**

**1.01 SUMMARY**

- A. Demonstration of products and systems where indicated in specific specification sections.
- B. Training of Owner personnel in operation and maintenance is required for:
  - 1. All software-operated systems.
  - 2. HVAC systems and equipment.
  - 3. Plumbing equipment.
  - 4. Electrical systems and equipment.
  - 5. Items specified in individual product Sections.
- C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
  - 1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
  - 2. Finishes, including flooring, wall finishes, ceiling finishes.
  - 3. Fixtures and fittings.
  - 4. Items specified in individual product Sections.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 7800 - Closeout Submittals: Operation and maintenance manuals.

**1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Training Plan: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
  - 1. Submit to Architect for transmittal to Owner.
  - 2. Submit not less than four weeks prior to start of training.
  - 3. Revise and resubmit until acceptable.
  - 4. Provide an overall schedule showing all training sessions.
  - 5. Include at least the following for each training session:
    - a. Identification, date, time, and duration.
    - b. Description of products and/or systems to be covered.
    - c. Name of firm and person conducting training; include qualifications.
    - d. Intended audience, such as job description.
    - e. Objectives of training and suggested methods of ensuring adequate training.
    - f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
    - g. Media to be used, such as slides, hand-outs, etc.
    - h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.
- C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
  - 1. Include applicable portion of O&M manuals.
  - 2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
  - 3. Provide one extra copy of each training manual to be included with operation and maintenance data.
- D. Training Reports:
  - 1. Identification of each training session, date, time, and duration.
  - 2. Sign-in sheet showing names and job titles of attendees.
  - 3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.



#### **1.04 QUALITY ASSURANCE**

- A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
  - 1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
  - 2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

#### **PART 2 PRODUCTS - NOT USED**

#### **PART 3 EXECUTION**

##### **3.01 DEMONSTRATION - GENERAL**

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.
- B. Demonstration may be combined with Owner personnel training if applicable.
- C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
  - 1. Perform demonstrations not less than two weeks prior to Final Completion.
  - 2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
  - 1. Perform demonstrations not less than two weeks prior to Final Completion.

##### **3.02 TRAINING - GENERAL**

- A. Conduct training on-site unless otherwise indicated.
- B. Owner will provide classroom and seating at no cost to Contractor.
- C. Provide training in minimum two hour segments.
- D. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.
- E. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
  - 1. The location of the O&M manuals and procedures for use and preservation; backup copies.
  - 2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
  - 3. Typical uses of the O&M manuals.
- F. Product- and System-Specific Training:
  - 1. Review the applicable O&M manuals.
  - 2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
  - 3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
  - 4. Provide hands-on training on all operational modes possible and preventive maintenance.
  - 5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
  - 6. Discuss common troubleshooting problems and solutions.
  - 7. Discuss any peculiarities of equipment installation or operation.
  - 8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.

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9. Review recommended tools and spare parts inventory suggestions of manufacturers.
  10. Review spare parts and tools required to be furnished by Contractor.
  11. Review spare parts suppliers and sources and procurement procedures.
- G. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

**END OF SECTION**

**SECTION 033000  
CAST-IN-PLACE CONCRETE**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
  - 1. Footings.
  - 2. Slabs-on-grade.
  - 3. Suspended slabs.
- B. Related Sections:
  - 1. Division 31 for drainage fill under slabs-on-grade.
  - 2. Division 32 for concrete pavement and walks.

**1.3 DEFINITIONS**

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

**1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
  - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
  - 1. Location of construction joints is subject to approval of the Architect.
- E. Samples: For waterstops and vapor retarder.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Welding certificates.
- C. Material Certificates: For each of the following, signed by manufacturers:
  - 1. Cementitious materials.
  - 2. Admixtures.
  - 3. Steel reinforcement and accessories.
  - 4. Bonding agents.
  - 5. Adhesives.
  - 6. Vapor retarders.
  - 7. Semirigid joint filler.
  - 8. Joint-filler strips.
  - 9. Repair materials.
- D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
  - 1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- F. Field quality-control reports.
- G. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
  - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."
- E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
  - 1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5 and Section 7, "Lightweight Concrete."

2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
  - F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
    1. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
      - a. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
      - b. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
  - G. Preinstallation Conference: Conduct conference at Project site.
    1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
      - a. Contractor's superintendent.
      - b. Independent testing agency responsible for concrete design mixtures.
      - c. Ready-mix concrete manufacturer.
      - d. Concrete subcontractor.
      - e. Special concrete finish subcontractor.
    2. Review testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.
    3. Review floor finishes to be installed and coordinate with curing methods to be used.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
  - B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

## PART 2 - PRODUCTS

### 2.1 FORM-FACING MATERIALS

- A. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- C. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

## 2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

## 2.3 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
  - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

## 2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
  - 1. Portland Cement: ASTM C 150, Type I/II. Supplement with the following:
    - a. Fly Ash: ASTM C 618, Class F.
- B. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
  - 1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
  - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94/C 94M and potable.

## 2.5 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
  - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
  - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
  - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
  - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
  - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
  - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing

chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Axim Italcementi Group, Inc.; CATEXOL CN-CI
  - b. BASF Construction Chemicals - Building Systems; Rheocrete CNI
  - c. Euclid Chemical Company (The), an RPM company; ARRMATECT, EUCON BCN, or EUCON CIA
  - d. Grace Construction Products, W. R. Grace & Co.; DCI
  - e. Sika Corporation; Sika CNI

## 2.6 WATERSTOPS

- A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Carlisle Coatings & Waterproofing, Inc.; MiraSTOP.
  - b. CETCO; Volclay Waterstop-RX.
  - c. Concrete Sealants Inc.; Con Seal CS-231.
  - d. Greenstreak; Swellstop.
  - e. Henry Company, Sealants Division; Hydro-Flex.
  - f. JP Specialties, Inc.; Earth Shield Type 20.

## 2.7 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape. Maximum perm rating of 0.02.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Fortifiber Building Systems Group; Moistop Ultra 15
  - b. Grace Construction Products, W. R. Grace & Co.; Florprufe 120
  - c. Insulation Solutions, Inc.; Viper VaporCheck II
  - d. Meadows, W. R., Inc.; Perminator 15 mil
  - e. Raven Industries Inc.; Vapor Block 15
  - f. Reef Industries, Inc.; Griffolyn 15 mil Green
  - g. Stego Industries, LLC; Stego Wrap 15 mil Class A

2. Provide manufacturer's compatible sealer system for penetrations.

- B. Granular Fill: Provide one of the following:

- a. Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
- b. Clean sands with less than 3 percent fines. Materials to be verified by a qualified Geotechnical Engineer.

- C. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch sieve, 10 to 30 percent

passing a No. 100 sieve, and at least 5 percent passing No. 200 sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

## 2.8 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.

## 2.9 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.
- C. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
  - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

## 2.10 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
  - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
  - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
  - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
  - 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
  - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
  - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.



3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

#### 2.11 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
  1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
  1. Fly Ash: 25 percent.
  2. Combined Fly Ash and Pozzolan: 25 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
  1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
  2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
  3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
  4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

#### 2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings: Proportion normal-weight concrete mixture as follows:
  1. Minimum Compressive Strength: 3000 psi at 28 days.
  2. Slump Limit: 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
- B. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
  1. Minimum Compressive Strength – typical interior slab: 3000 psi at 28 days.
  2. Minimum Compressive Strength – Apparatus Bay slab: 4000 psi at 28 days.
  3. Minimum Compressive Strength – Typical Exterior Slab: 4000 psi (27.6 MPa) at 28 days.
  4. Minimum Compressive Strength – Washer Pad: 3500 psi (27.6 MPa) at 28 days.
  5. Slump Limit: 4 inches, plus or minus 1 inch.
  6. Air Content: For exterior broom finished concrete only; 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
  7. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
- C. Suspended Slabs: Proportion normal-weight concrete mixture as follows:

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1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Slump Limit: 4 inches, plus or minus 1 inch.
3. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

### 2.13 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

### 2.14 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
  1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

## PART 3 - EXECUTION

### 3.1 FORMWORK

- A. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- B. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
  1. Class A, 1/8 inch for smooth-formed finished surfaces.
- C. Construct forms tight enough to prevent loss of concrete mortar.
- D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
  1. Install keyways, reglets, recesses, and the like, for easy removal.
  2. Do not use rust-stained steel form-facing material.
- E. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- F. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- G. Chamfer exterior corners and edges of permanently exposed concrete.
- H. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

- J. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- K. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

### 3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

### 3.3 VAPOR RETARDERS

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
  - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.
  - 2. Seal around all penetrations with manufacturer's recommended system.

### 3.4 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
  - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
  - 1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

### 3.5 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

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1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
  2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
  3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
  2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
  2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
  3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- 3.6 CONCRETE PLACEMENT
- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
  2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  2. Maintain reinforcement in position on chairs during concrete placement.
  3. Screed slab surfaces with a straightedge and strike off to correct elevations.
  4. Slope surfaces uniformly to drains where required.
  5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
  2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- G. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

### 3.7 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete.

- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

### 3.8 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
  - 1. Apply scratch finish to surfaces indicated and to receive mortar setting beds for bonded cementitious floor finishes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
  - 1. Apply float finish to surfaces indicated to receive trowel finish.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
  - 1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
  - 2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
    - a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F)24; and of levelness, F(L) 17.
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
  - 1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
  - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.9 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.10 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
  - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
  - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days.

Immediately repair any holes or tears during curing period using cover material and waterproof tape.

- a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
- b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
- c. Cure concrete surfaces to receive floor coverings with a moisture-retaining cover.

### 3.11 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
  1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

### 3.12 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
  1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
  2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
  3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
  1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate



to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

### 3.13 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.
7. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

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1. Testing Frequency: Samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, nor less than once for each 150 cu. yd. (114 cu. m) of concrete, nor less than once for each 5,000 sq. ft. of surface area for slabs or walls.
  2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
  3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
  5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  6. Compression Test Specimens: ASTM C 31/C 31M.
    - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
  7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
  8. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
  9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
  10. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
  11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
  12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- D. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

**END OF SECTION**

**SECTION 03 3511  
CONCRETE FLOOR FINISHES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Concrete stains and dyes.
- B. Clear coatings.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 3000 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.
- B. Section 09 6700 - Fluid-Applied Flooring.

**1.03 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate the work with concrete floor placement and concrete floor curing.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.
- C. Maintenance Data: Provide data on maintenance and renewal of applied finishes.
- D. Warranty Documentation: Manufacturer warranty; ensure that forms have been completed in Owner's name and registered with manufacturer.

**1.05 MOCK-UP**

- A. For coatings, construct mock-up area under conditions similar to those that will exist during application, with coatings applied.
- B. Mock-Up Size: 10 feet square.
- C. Locate where directed.
- D. Mock-up may remain as part of the work.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials in manufacturer's sealed packaging, including application instructions.

**1.07 FIELD CONDITIONS**

- A. Maintain light level equivalent to a minimum 200 W light source at 8 feet above the floor surface over each 20 foot square area of floor being finished.
- B. Maintain ambient temperature of 50 degrees F minimum.

**1.08 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective work within a two-year period commencing on the Date of Substantial Completion.

**PART 2 PRODUCTS**

**2.01 CONCRETE FLOOR FINISH APPLICATIONS**

- A. Clear Coating:

**2.02 COATINGS**

- A. Concrete Stain or Dye: Translucent, penetrating compound for interior or exterior use; must be finished with a topical sealer.
  - 1. Primary Color: as selected from manufacturer's full range of colors.
  - 2. Application:
    - a. Primary Color: Spray applied.

3. Composition: Water-based, nonreactive.
4. Basis of Design: Euclid Chemical Company; STONE ESSENCE:
  - a. Other Products:
    - 1) Clemons Concrete Coatings: [www.clemonsconcretecoatings.com/#sle](http://www.clemonsconcretecoatings.com/#sle).
    - 2) PROSOCO, Inc; GemTone Stain: [www.prosoco.com/consolideck/#sle](http://www.prosoco.com/consolideck/#sle).
    - 3) Substitutions: See Section 01 6000 - Product Requirements.
  - B. High Gloss Clear Coating: Transparent, nonyellowing, acrylic polymer-based coating.
    1. Composition: Solvent-based.
    2. Basis of Design: Euclid Chemical Company: Increte Clear Seal: [www.euclidchemical.com](http://www.euclidchemical.com)
      - a. Other Products:
      - b. Clemons Concrete Coatings: [www.clemonsconcretecoatings.com/#sle](http://www.clemonsconcretecoatings.com/#sle).
      - c. PROSOCO, Inc: [www.prosoco.com/consolideck/#sle](http://www.prosoco.com/consolideck/#sle).
      - d. Substitutions: See Section 01 6000 - Product Requirements.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that floor surfaces are acceptable to receive the work of this section.
- B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

#### **3.02 GENERAL**

- A. Apply materials in accordance with manufacturer's instructions.

#### **3.03 COATING APPLICATION**

- A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.
- B. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.
- C. Apply coatings in accordance with manufacturer's instructions, matching approved mock-ups for color, special effects, sealing and workmanship.

#### **END OF SECTION**

**SECTION 04 2000  
UNIT MASONRY**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Concrete block.
- B. Clay facing brick.
- C. Mortar and grout.
- D. Reinforcement and anchorage.
- E. Flashings.
- F. Lintels.
- G. Accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 05 5000 - Metal Fabrications: Loose steel lintels.
- B. Section 07 2500 - Weather Barriers: Water-resistive barriers applied to exterior face of backing sheathing or unit masonry substrate.
- C. Section 07 6200 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.
- D. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

**1.03 REFERENCE STANDARDS**

- A. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019.
- B. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2022.
- C. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2022.
- D. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2023.
- E. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.
- F. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale); 2023.
- G. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019a, with Editorial Revision.
- H. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2024.
- I. ASTM C476 - Standard Specification for Grout for Masonry; 2023.
- J. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2016.
- K. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.
- L. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls; 2017.
- M. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls; 2005.
- N. BIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2017.
- O. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

### **1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
- C. Samples: Submit sample board of facing brick units to illustrate color, texture, and extremes of color range.
- D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.
- E. Installer's Qualification Statement.

### **1.06 QUALITY ASSURANCE**

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
- B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

### **1.07 MOCK-UPS**

- A. Construct a masonry wall as a mock-up panel sized 8 feet long by 6 feet high; include mortar, accessories, structural backup, and flashings (with lap joint, corner, and end dam) in mock-up.
- B. Locate where directed.

### **1.08 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

## **PART 2 PRODUCTS**

### **2.01 CONCRETE MASONRY UNITS**

- A. Manufacturers:
  - 1. Adams: [www.adamsproducts.com](http://www.adamsproducts.com)
  - 2. Carolina Prestress: [www.carolinaprestress.com](http://www.carolinaprestress.com)
  - 3. Johnson Concrete: [www.johnsoncmu.com](http://www.johnsoncmu.com)
- B. Concrete Block: Comply with referenced standards and as follows:
  - 1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on drawings for specific locations.
  - 2. Load-Bearing Units: ASTM C90, lightweight.
    - a. Hollow block, as indicated.
    - b. Exposed Faces: Manufacturer's standard color and texture.
    - c. Strength:  $F'c = 2,000$  psi.

### **2.02 BRICK UNITS**

- A. Manufacturers:
  - 1. General Shale Brick; Architectural Series, Wirecut: [www.generalshale.com/#sle](http://www.generalshale.com/#sle).
    - a. Color 1: Steel
    - b. Color 1: Chocolate
  - 2. Palmetto Brick; Architectural Series, Wirecut, [Palmettobrick.com](http://Palmettobrick.com).
    - a. Color 1: Pewter
    - b. Color 2: Mocha
  - 3. Interstate Brick; Modular, Wirecut, [Interstatebrick.com](http://Interstatebrick.com).
    - a. Color 1: Pewter
    - b. Color 2: Walnut
  - 4. Glen-Gery; Hanley Classics Series, Wirecut, [www.glengery.com](http://www.glengery.com)
    - a. Color 1: Cool Gray

- b. Color 2: Baxter Brown
- 5. Substitutions: See section 01 6000 - Product Requirements.
- B. Facing Brick: ASTM C216, Type FBS Smooth, Grade SW.
  - 1. Nominal size: Modular.
  - 2. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.

### 2.03 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.
- B. Grout Aggregate: ASTM C404.
- C. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
  - 1. Color(s): As selected by Architect from manufacturer's full range.
- D. Water: Clean and potable.

### 2.04 REINFORCEMENT AND ANCHORAGE

- A. Reinforcing Steel: Type and size as indicated on structural drawings.
- B. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.
- C. Single Wythe Joint Reinforcement: ASTM A951/A951M.
  - 1. Type: Truss or ladder.
  - 2. Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M Class 3.
  - 3. Size: 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.
- D. Adjustable Multiple Wythe Joint Reinforcement: ASTM A951/A951M.
  - 1. Type: Truss, with adjustable ties or tabs spaced at 16 in on center. Eye and pintle type.
  - 2. Size: 0.1875 inch side rods with 0.1483 inch cross rods and adjustable components of 0.1875 inch wire, width of components as required to provide not less than 5/8 inch of mortar coverage from each masonry face.
  - 3. Vertical adjustment: Not more than 2 inches.
  - 4. Insulation Clips: Provide clips at tabs or ties designed to secure insulation against outer face of inner wythe of masonry.
- E. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, 304 Stainless.
  - 1. Accessories:
    - a. Insulation retaining washers.
    - b. Stainless steel self-drilling fasteners, 2 per plate.
  - 2. Manufacturers:
    - a. Hohmann & Barnard, Inc; HB-213-2X with washer: [www.h-b.com/#sle](http://www.h-b.com/#sle).
    - b. Heckmann Building Products; 213 Double Pintle Plate Veneer Anchor, 282 Double Pintle Tie, insulation retaining washer: [www.heckmannbuildingprods.com](http://www.heckmannbuildingprods.com).
    - c. Wire-Bond; 2407 with Lock Washer: [www.wirebond.com](http://www.wirebond.com).
    - d. Substitutions: See Section 01 6000 - Product Requirements.

### 2.05 FLASHINGS

- A. Metal Flashing Materials:
- B. Combination Asphaltic Flashing Materials - Copper:
  - 1. Copper/Asphalt Flashing: 5 oz/sq ft copper sheet bonded between 2 layers asphalt saturated glass fabric.

## **2.06 ACCESSORIES**

- A. Preformed Control Joints for CMU: Rubber material. Provide with corner and tee accessories, fused joints.
  - 1. Manufacturers:
    - a. Blok-Lok Limited: [www.blok-lok.com/#sle](http://www.blok-lok.com/#sle).
    - b. Hohmann & Barnard, Inc: [www.h-b.com/#sle](http://www.h-b.com/#sle).
    - c. WIRE-BOND: [www.wirebond.com/#sle](http://www.wirebond.com/#sle).
- B. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
- C. Cavity Vents:
  - 1. Type: Clear polymer grid, 3/8 x 3-5/8x 2-1/2 inch.
- D. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

## **2.07 LINTELS**

- A. As shown on structural drawings.

## **2.08 MORTAR AND GROUT MIXING**

- A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
  - 1. Masonry below grade and in contact with earth: Type S.
  - 2. Exterior, loadbearing masonry: Type N.
  - 3. Exterior, non-loadbearing masonry: Type N.
  - 4. Interior, loadbearing masonry: Type N.
- B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.
- C. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

### **3.02 COURSING**

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
  - 1. Bond: Running.
  - 2. Coursing: One unit and one mortar joint to equal 8 inches.
  - 3. Mortar Joints: Concave.
- D. Brick Units:
  - 1. Bond: As indicated for different locations.
  - 2. Coursing: Three units and three mortar joints to equal 8 inches.

### **3.03 PLACING AND BONDING**

- A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
- B. Remove excess mortar and mortar smears as work progresses.
- C. Interlock intersections and external corners, except for units laid in stack bond.



- D. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- E. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- F. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

#### **3.04 WEEPS/CAVITY VENTS**

- A. Install weeps in veneer and cavity walls at 24 inches on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.
- B. Install cavity vents in veneer and cavity walls at 24 inches on center horizontally below shelf angles and lintels and near top of walls.

#### **3.05 CAVITY MORTAR CONTROL**

- A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.
- B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.
- C. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

#### **3.06 REINFORCEMENT AND ANCHORAGE - GENERAL, SINGLE WYTHE MASONRY, AND CAVITY WALL MASONRY**

- A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 8 inches each side of opening.
- C. Place continuous joint reinforcement in first and second joint below top of walls.
- D. Embed longitudinal wires of joint reinforcement in mortar joint with at least 5/8 inch mortar cover on each side.
- E. Lap joint reinforcement ends minimum 6 inches.

#### **3.07 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER**

- A. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches on center vertically and 16 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 16 inches on center.
- B. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches on center vertically and 16 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

#### **3.08 MASONRY FLASHINGS**

- A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
  - 1. Extend flashings full width at such interruptions and at least 8 inches, minimum, into adjacent masonry or turn up flashing ends at least 8 inches, minimum, to form watertight pan at nonmasonry construction.
  - 2. Remove or cover protrusions or sharp edges that could puncture flashings.
  - 3. Seal lapped ends and penetrations of flashing before covering with mortar.
- B. Install flashing in accordance with manufacturer's instructions and BIA Technical Notes No. 7.
- C. Extend metal flashings to within 1/4 inch of exterior face of masonry.
- D. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

### **3.09 LINTELS**

- A. Install loose steel lintels over openings.
- B. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.

### **3.10 GROUTED COMPONENTS**

- A. Place and consolidate grout fill without displacing reinforcing.

### **3.11 CONTROL AND EXPANSION JOINTS**

- A. Do not continue horizontal joint reinforcement through control or expansion joints.
- B. Locate joints as indicated on drawings, and at 30 feet maximum. Verify locations with Architect prior to proceeding with work.
- C. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

### **3.12 BUILT-IN WORK**

- A. As work progresses, install built-in metal door frames and glazed frames and other items to be built into the work and furnished under other sections.
- B. Install built-in items plumb, level, and true to line.
- C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
  - 1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

### **3.13 TOLERANCES**

- A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
- C. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.
- E. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.

### **3.14 CUTTING AND FITTING**

- A. Cut and fit for pipes and conduit. Coordinate with other sections of work to provide correct size, shape, and location.
- B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

### **3.15 CLEANING**

- A. Remove excess mortar and mortar droppings.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.
- D. Use non-metallic tools in cleaning operations.

### **3.16 PROTECTION**

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

**END OF SECTION**

**SECTION 051200  
STRUCTURAL STEEL FRAMING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

A. Section Includes:

- 1. Structural steel.
- 2. Grout.

B. Related Sections:

- 1. Section 014000 "Quality Requirements" for independent testing agency procedures and administrative requirements.
- 2. Section 053100 "Steel Decking".
- 3. Section 055000 "Metal Fabrications" for miscellaneous steel fabrications not defined as structural steel.
- 4. Section 055113 "Metal Pan Stairs."
- 5. Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" for surface-preparation and priming requirements.

**1.3 DEFINITIONS**

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

**1.4 PERFORMANCE REQUIREMENTS**

- A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering analysis by a qualified professional engineer, to withstand loads indicated and comply with other information and restrictions indicated.

- 1. Select and complete connections using schematic details indicated and AISC 360.
- 2. Use LRFD; data are given at factored-load level.

- B. Construction: Steel Braced Frames

**1.5 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural-steel components.
  - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
  - 2. Include embedment drawings.

3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
  4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts.
  5. Identify demand critical welds.
  6. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:
1. Power source (constant current or constant voltage).
  2. Electrode manufacturer and trade name, for demand critical welds.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer, fabricator, professional engineer and testing agency.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Mill test reports for structural steel, including chemical and physical properties.
- E. Product Test Reports: For the following:
  1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
  2. Shop primers.
  3. Nonshrink grout.
- F. Source quality-control reports.

#### 1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.
- D. Comply with applicable provisions of the following specifications and documents:
  1. AISC 303.
  2. AISC 341 and AISC 341s1.
  3. AISC 360.

4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

E. Preinstallation Conference: Conduct conference at Project site.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.

2. Clean and relubricate bolts and nuts that become dry or rusty before use.

3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

#### 1.9 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

### PART 2 - PRODUCTS

#### 2.1 STRUCTURAL-STEEL MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. W-Shapes: ASTM A 992/A 992M.

C. Channels and Angles: ASTM A 36/A 36M.

D. Plate and Bar: ASTM A 36/A 36M.

E. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

F. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.

1. Weight Class: Standard unless noted otherwise.

2. Finish: Black except where indicated to be galvanized.

G. Welding Electrodes: Comply with AWS requirements.

## 2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.
- B. High-Strength Bolts, Nuts, and Washers: ASTM A 490 (ASTM A 490M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH, (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers with plain finish.
- C. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
- D. Unheaded Anchor Rods: ASTM F 1554, Grade 36.
  - 1. Configuration: Straight.
  - 2. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
  - 3. Plate Washers: ASTM A 36/A 36M carbon steel.
  - 4. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
  - 5. Finish: Plain.
- E. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.
  - 1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
  - 2. Plate Washers: ASTM A 36/A 36M carbon steel.
  - 3. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
  - 4. Finish: Plain.
- F. Threaded Rods: ASTM A 36/A 36M.
  - 1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
  - 2. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
  - 3. Finish: Plain.

## 2.3 PRIMER

- A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- B. Galvanizing Repair Paint: ASTM A 780.

## 2.4 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

## 2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
  - 1. Camber structural-steel members where indicated.
  - 2. Fabricate beams with rolling camber up.

3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
  4. Mark and match-mark materials for field assembly.
  5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning."
- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- G. Welded Door Frames: Build up welded door frames attached to structural steel. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than 10 inches o.c. unless otherwise indicated.
- H. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
  2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
  3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

## 2.6 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

## 2.7 SOURCE QUALITY CONTROL

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
- B. The Fabricator shall be a designated AISC-Certified Plant, Category STD or the Fabricator at their expense shall engage an independent testing and inspecting agency to perform shop tests and

inspections and prepare test reports, this expense shall be added to the Non-Certified Fabricator's bid.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- C. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- D. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- E. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
1. Liquid Penetrant Inspection: ASTM E 165.
  2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
  3. Ultrasonic Inspection: ASTM E 164.
  4. Radiographic Inspection: ASTM E 94.

## 2.8 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
  2. Surfaces to be field welded.
  3. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
1. SSPC-SP 2, "Hand Tool Cleaning."
  2. SSPC-SP 3, "Power Tool Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

## 2.9 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
  2. Galvanize all building columns, lintels and shelf angles.



## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
  - 1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

### 3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Base Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
  - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
  - 2. Weld plate washers to top of baseplate, where indicated.
  - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
  - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
  - 1. Level and plumb individual members of structure.
  - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection.

- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

### 3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type: Snug tightened unless otherwise indicated.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
  - 2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
  - 3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

### 3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
- B. Bolted Connections: Bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.
  - 1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
    - a. Liquid Penetrant Inspection: ASTM E 165.
    - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
    - c. Ultrasonic Inspection: ASTM E 164.
    - d. Radiographic Inspection: ASTM E 94.
- D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
  - 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
  - 2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.
- E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.
- B. Touchup Painting: Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

**END OF SECTION**

**SECTION 053100  
STEEL DECKING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

A. Section Includes:

- 1. Roof deck.
- 2. Composite floor deck.

B. Related Requirements:

- 1. Section 033000 "Cast-in-Place Concrete" for normal-weight and lightweight structural concrete fill over steel deck.
- 2. Division 051200 Section "Structural Steel Framing" for shop- and field-welded shear connectors.
- 3. Section 055000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings:

- 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Welding certificates.

- B. Product Certificates: For each type of steel deck.

- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

- 1. Power-actuated mechanical fasteners.

- D. Evaluation Reports: For steel deck.

- E. Field quality-control reports.

## 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
- C. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

### 2.2 ROOF DECK

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. ASC Profiles, Inc.; a Blue Scope Steel company.
  - 2. Canam United States; Canam Group Inc.
  - 3. CMC Joist & Deck.
  - 4. Consolidated Systems, Inc.; Metal Dek Group.
  - 5. Cordeck.
  - 6. DACS, Inc.
  - 7. Epic Metals Corporation.
  - 8. Marlyn Steel Decks, Inc.
  - 9. New Millennium Building Systems, LLC.
  - 10. Nucor Corp.; Vulcraft Group.

11. Roof Deck, Inc.
12. Valley Joist; Subsidiary of EBSCO Industries, Inc.
13. Verco Manufacturing Co.
14. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:

1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G90 (Z275) zinc coating.
2. Deck Profile: Type WR, wide rib.
3. Profile Depth: 1-1/2 inches (38 mm).
4. Design Uncoated-Steel Thickness: 0.0358 inches.
5. Span Condition: Triple span or more.
6. Side Laps: Overlapped or interlocking seam at Contractor's option.

## 2.3 COMPOSITE FLOOR DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ASC Profiles, Inc.; a Blue Scope Steel company.
2. Canam United States; Canam Group Inc.
3. CMC Joist & Deck.
4. Consolidated Systems, Inc.; Metal Dek Group.
5. Cordeck.
6. DACS, Inc.
7. Epic Metals Corporation.
8. Marlyn Steel Decks, Inc.
9. New Millennium Building Systems, LLC.
10. Nucor Corp.; Vulcraft Group.
11. Roof Deck, Inc.
12. Verco Manufacturing Co.
13. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:

1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 (230), G90 (Z275) zinc coating.
2. Profile Depth: 2 inches (51 mm).
3. Design Uncoated-Steel Thickness: 0.0358 inch (1.06 mm).
4. Span Condition: Triple span or more.

## 2.4 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven stainless steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, stainless steel screws, No. 10 (4.8-mm) minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile indicated.
- G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
- I. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch (1.90 mm) thick, of same material and finish as deck, with 3-inch- (76-mm-) wide flanges and level recessed pans of 1-1/2-inch (38-mm) minimum depth. For drains, cut holes in the field.
- J. Galvanizing Repair Paint: ASTM A 780.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.

- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

### 3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to light gauge roof trusses or rafters with self-tapping TEK stainless steel screws as noted on plan.
- B. Fasten roof-deck panels to steel beams and steel bar joists with powder actuated fasteners as noted on plan.
- C. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 36 inches (914 mm), or as noted on plans and as follows:
  - 1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, stainless steel screws.
- D. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:
  - 1. End Joints: Lapped 2 inches (51 mm) minimum or butted at Contractor's option.
- E. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches (305 mm) apart with at least one fastener at each corner.
  - 1. Install reinforcing channels or zees in ribs to span between supports and mechanically fasten.
- F. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.
  - 1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.



- G. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

### 3.4 FLOOR-DECK INSTALLATION

- A. Fasten floor-deck panels to steel supporting members by welding a shear connector through the deck or by arc spot (puddle) welds of the surface diameter indicated and as follows:
  - 1. Weld Diameter: 3/4 inch (19 mm), nominal.
  - 2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inches (305 mm) apart, but not more than 18 inches (457 mm) apart or as indicated on plans or brace sections.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 36 inches (914 mm), and as follows:
  - 1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:
  - 1. End Joints: Lapped or butted at Contractor's option.
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.
- E. Install piercing hanger tabs at 14 inches (355 mm) apart in both directions, within 9 inches (228 mm) of walls at ends, and not more than 12 inches (305 mm) from walls at sides unless otherwise indicated.

### 3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Field welds will be subject to inspection.
- C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

**END OF SECTION**

**SECTION 054000  
COLD-FORMED METAL FRAMING**

**COLD-FORMED METAL FRAMING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

A. Section Includes:

- 1. Exterior non-load-bearing wall framing.
- 2. Soffit framing.

B. Related Requirements:

- 1. Section 055000 "Metal Fabrications" for masonry shelf angles and connections.
- 2. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies.
- 3. Section 092216 "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

**1.3 PERFORMANCE REQUIREMENTS**

- A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.

- 1. Design Loads: As indicated.
- 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
  - a. Exterior Wall Framing: Horizontal deflection of 1/240 of the wall height.
  - b. Interior Wall Framing: Horizontal deflection of 1/240 of the wall height under a horizontal load of 5 lbf/sq. ft. (239 Pa).
  - c. Ceiling Joist Framing: Vertical deflection of 1/360 of the span.
- 3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).
- 4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

- a. Upward and downward movement of 3/4 inch (19 mm) at non-load bearing walls only.
  - B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
    - 1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
    - 2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
- 1.4 ACTION SUBMITTALS
- A. Product Data: For each type of cold-formed steel framing product and accessory.
  - B. Shop Drawings:
    - 1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
    - 2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
  - C. Delegated-Design Submittal: For cold-formed steel framing.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency.
  - 1. Steel sheet.
  - 2. Expansion anchors.
  - 3. Power-actuated anchors.
  - 4. Mechanical fasteners.
  - 5. Vertical deflection clips.
  - 6. Horizontal drift deflection clips
  - 7. Miscellaneous structural clips and accessories.
- D. Research Reports: For non-standard cold-formed steel framing, from ICC-ES.

1.6 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-

formed metal framing that are similar to those indicated for this Project in material, design, and extent.

- C. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- D. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- E. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
- F. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
- G. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."
  - 1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."
- H. Preinstallation Conference: Conduct conference at Project site.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
  - 1. AllSteel & Gypsum Products, Inc.
  - 2. California Expanded Metal Products Company.
  - 3. ClarkWestern Building Systems, Inc.
  - 4. Consolidated Fabricators Corp.; Building Products Division.
  - 5. Craco Mfg., Inc.
  - 6. Custom Stud Inc.
  - 7. Design Shapes in Steel.
  - 8. Dietrich Metal Framing; a Worthington Industries Company.
  - 9. Formetal Co. Inc. (The).
  - 10. MarinoWARE.
  - 11. Nuconsteel; a Nucor Company.

12. Olmar Supply, Inc.
13. Quail Run Building Materials, Inc.
14. SCAFCO Corporation.
15. Southeastern Stud & Components, Inc.
16. State Building Products, Inc.
17. Steel Construction Systems.
18. Steel Network, Inc. (The).
19. Steel Structural Systems.
20. Steeler, Inc.
21. Super Stud Building Products, Inc.
22. Telling Industries, LLC.
23. United Metal Products, Inc.
24. United Steel Manufacturing.

B. Cold-Formed Steel Framing Design Standards:

1. Wall Studs: AISI S211.
2. Headers: AISI S212.
3. Lateral Design: AISI S213.

C. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.

D. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

## 2.2 MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: As required by structural performance.
2. Coating: G90 (Z275).

C. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by structural performance.
2. Coating: G90 (Z275).

## 2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

## 05 4000 Cold-Formed Metal Framing

1. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
  2. Flange Width: As required by design.
  3. Section Properties: As required by design.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: Matching steel studs.
  2. Flange Width: 1-1/4 inches (32 mm).
- C. Vertical Deflection Clips: Manufacturer's standard head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
    - a. AllSteel & Gypsum Products, Inc.
    - b. ClarkWestern Building Systems, Inc.
    - c. Dietrich Metal Framing; a Worthington Industries company.
    - d. MarinoWARE.
    - e. SCAFCO Corporation.
    - f. Steel Network, Inc. (The).
    - g. Steeler, Inc.
- D. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
    - a. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
    - b. Flange Width: 1 inch (25 mm) plus the design gap of 3/4 inch.
  2. Inner Track: Of web depth indicated, and as follows:
    - a. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
    - b. Flange Width: 2 3/4 inches.
  - 3.

### 2.4 SOFFIT FRAMING

- A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
  2. Flange Width: 1-5/8 inches (41 mm), minimum.
  3. Section Properties: As required by design.

## 2.5 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
  - 1. Supplementary framing.
  - 2. Bracing, bridging, and solid blocking.
  - 3. Web stiffeners.
  - 4. Anchor clips.
  - 5. End clips.
  - 6. Foundation clips.
  - 7. Gusset plates.
  - 8. Stud kickers and knee braces.
  - 9. Joist hangers and end closures.
  - 10. Hole reinforcing plates.
  - 11. Backer plates.

## 2.6 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
- E. Mechanical Fasteners: ASTM C 1513, stainless steel, self-drilling, self-tapping, steel drill screws.
  - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

## 2.7 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B.



- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30-minute working time.
- D. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.
- E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

## 2.8 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
  - 1. Fabricate framing assemblies using jigs or templates.
  - 2. Cut framing members by sawing or shearing; do not torch cut.
  - 3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
    - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by no fewer than three exposed screw threads.
  - 4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
  - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
  - 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200 and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
  - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
  - 1. Cut framing members by sawing or shearing; do not torch cut.
  - 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
    - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    - b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 072100 "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.
- J. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
  - 1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

### 3.3 NON LOAD-BEARING WALL INSTALLATION

- A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
  - 1. Anchor Spacing: As shown on Shop Drawings.
- B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/16 inch between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:
  - 1. Stud Spacing: 16 inches (406 mm).
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
- D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.
- E. Align floor and roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads.
- F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.
- G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
  - 1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
  - 2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
- H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
  - 1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

- I. Install horizontal bridging in stud system, spaced 48 inches (1220 mm). Fasten at each stud intersection.
  - 1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of 2 screws into each flange of the clip angle for framing members up to 6 inches (150 mm) deep.
  - 2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
  - 3. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- J. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

### 3.4 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### 3.5 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

### END OF SECTION

**SECTION 05 5100  
METAL STAIRS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Stairs with metal treads.
- B. Stairs with grating treads.
- C. Structural steel stair framing and supports.
- D. Handrails and guards.

**1.02 REFERENCE STANDARDS**

- A. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures; 2006.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
- C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
- D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.
- F. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.
- G. ASTM A786/A786M - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates; 2015 (Reapproved 2021).
- H. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.
- I. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.
- J. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2023.
- K. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.
- L. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021.
- M. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
- N. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.
- O. NAAMM AMP 510 - Metal Stairs Manual; 1992.
- P. NAAMM MBG 531 - Metal Bar Grating Manual; 2017.
- Q. NAAMM MBG 532 - Heavy Duty Metal Bar Grating Manual; 2019.
- R. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.
- S. SSPC-SP 2 - Hand Tool Cleaning; 1982, with Editorial Revision (2004).

**1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
2. Include the design engineer's seal and signature on each sheet of shop drawings.
- C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
- D. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is certified under AISC 201.
- E. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

#### **1.04 QUALITY ASSURANCE**

- A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.
- B. Fabricator Qualifications:
  1. A qualified steel fabricator that is certified by the American Institute for Steel Construction (AISC) under AISC 201.

### **PART 2 PRODUCTS**

#### **2.01 METAL STAIRS - GENERAL**

- A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.
  1. Regulatory Requirements: Provide stairs and railings that comply with most stringent requirements of local, state, and federal regulations; where requirements of Contract Documents exceed those of regulations, comply with Contract Documents.
  2. Handrails: Comply with applicable accessibility requirements of ADA Standards.
  3. Structural Design: Provide complete stair and railing assemblies that comply with the applicable local code.
  4. Dimensions: As indicated on drawings.
  5. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
  6. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
  7. Separate dissimilar metals using paint or permanent tape.
- B. Metal Jointing and Finish Quality Levels:
  1. Commercial: Exposed joints as inconspicuous as possible, whether welded or mechanical; underside of stair not covered by soffit IS considered exposed to view. (Stair and railing in Aparatus Bay)
    - a. Welded Joints: Intermittently welded on back side, filled with body putty, and sanded smooth and flush.
    - b. Welds Exposed to View: Ground smooth and flush.
    - c. Mechanical Joints: Butted tight, flush, and hairline.
    - d. Bolts Exposed to View: Countersunk flat or oval head bolts; no exposed nuts.
    - e. Exposed Edges and Corners: Eased to small uniform radius.
    - f. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for satin or matte finish.
  2. Industrial: All joints made neatly. (Stair in Mechancial Loft leading to Roof Access)
    - a. Welded Joints: Welded on back side wherever possible.
    - b. Welds Exposed to Touch: Ground smooth.
    - c. Bolts Exposed to Touch in Travel Area: No nuts or screw threads exposed to touch.
- C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

- D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

## **2.02 METAL STAIRS WITH METAL TREADS**

- A. Jointing and Finish Quality Level: Commercial, as defined above.
- B. Risers: Closed.
- C. Treads: Perforated steel plate.
  - 1. Tread Thickness: 1/4 inch, minimum.
  - 2. Anchorage to Stringers: Welded to carrier angles welded to stringers.
- D. Risers: Perforated steel sheet.
  - 1. Riser Thickness: As required by design; 14 gauge, 0.075 inch minimum.
  - 2. Riser/Nosing Profile: Sloped riser with rounded nosing of minimum radius.
- E. Stringers: Rolled steel channels.
  - 1. Stringer Depth: 12 inches.
  - 2. End Closure: Sheet steel of same thickness as risers welded across ends.
- F. Landings: Same construction as treads, supported and reinforced as required to achieve design load capacity.
- G. Railings: Steel pipe railings.
- H. Finish: Shop- or factory-prime painted.

## **2.03 METAL STAIRS WITH GRATING TREADS**

- A. Jointing and Finish Quality Level: Industrial, as defined above.
- B. Risers: Open.
- C. Treads: Steel bar grating.
  - 1. Grating Type: Welded.
  - 2. Bearing Bar Depth: 3/4 inch, minimum.
  - 3. Top Surface: Standard.
  - 4. Nosing: Checkered plate.
  - 5. Nosing Width: 1-1/4 inch, minimum.
  - 6. Anchorage to Stringers: End plates welded to grating, bolted to stringers.
- D. Stringers: Rolled steel channels.
  - 1. Stringer Depth: 10 inches.
  - 2. End Closure: Sheet steel, 14 gauge, 0.075 inch minimum; welded across ends.
- E. Railings: Steel pipe railings.
- F. Finish: Shop- or factory-prime painted.

## **2.04 HANDRAILS AND GUARDS**

- A. Guard Mounted Rails: Round pipe or tube rails unless otherwise indicated.
  - 1. Outside Diameter: 1-1/4 inch, minimum, to 1-1/2 inches, maximum.
- B. Guards:
  - 1. Top Rails: Round pipe or tube rails unless otherwise indicated.
    - a. Outside Diameter: 1-1/4 inch, minimum, to 1-1/2 inches, maximum.
  - 2. Infill at Mesh Railings: Perforated metal panels.
    - a. Material and Finish: Same as stair.
    - b. Mounting: Mesh welded to steel bar frame, frame welded to posts.
  - 3. End and Intermediate Posts: Same material and size as top rails.
    - a. Horizontal Spacing: As indicated on drawings.
    - b. Mounting: Welded to side surface of stringer or pour stop at mezzanine.

## **2.05 MATERIALS**

- A. Steel Sections: ASTM A36/A36M.

- B. Steel Tubing: ASTM A500/A500M or ASTM A501/A501M structural tubing, round and shapes as indicated.
- C. Pipe: ASTM A53/A53M Grade B Schedule 40, black finish.
- D. Checkered Plate: ASTM A786/A786M, rolled steel floor plate; manufacturer's standard pattern.
- E. Perforated Plate:
  - 1. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
  - 2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).
  - 3. Perforation Pattern: Round hole, 1/8 inch diameter, staggered pattern.
- F. Gratings: Bar gratings that comply with NAAMM MBG 531 or NAAMM MBG 532, whichever applies based on bar sizes.

## **2.06 ACCESSORIES**

- A. Steel Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.
- B. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- C. Shop and Touch-Up Primer: SSPC-Paint 15, and comply with VOC limitations of authorities having jurisdiction.

## **2.07 SHOP FINISHING**

- A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- B. Do not prime surfaces in direct contact with concrete or where field welding is required.
- C. Prime Painting: Use specified shop- and touch-up primer.
  - 1. Preparation of Steel: In accordance with SSPC-SP 2 Hand Tool Cleaning.
  - 2. Number of Coats: One.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field conditions are acceptable and are ready to receive work.

### **3.02 PREPARATION**

- A. When field welding is required, clean and strip primed steel items to bare metal.

### **3.03 INSTALLATION**

- A. Install components plumb and level, accurately fitted, free from distortion or defects.
- B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1/D1.1M.
- D. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.
- E. Obtain approval prior to site cutting or creating adjustments not scheduled.
- F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

**END OF SECTION**



**SECTION 06 1000  
ROUGH CARPENTRY**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Roofing nailers.
- B. Preservative treated wood materials.
- C. Communications and electrical room mounting boards.
- D. Concealed wood blocking, nailers, and supports.

**1.02 REFERENCE STANDARDS**

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- B. AWPA U1 - Use Category System: User Specification for Treated Wood; 2024.
- C. PS 1 - Structural Plywood; 2023.
- D. PS 20 - American Softwood Lumber Standard; 2021.

**1.03 DELIVERY, STORAGE, AND HANDLING**

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

**PART 2 PRODUCTS**

**2.01 GENERAL REQUIREMENTS**

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
  - 1. Species: Spruce-Pine-Fir (South), unless otherwise indicated.
  - 2. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
  - 3. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at [www.alsc.org](http://www.alsc.org), and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

**2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS**

- A. Sizes: Nominal sizes as indicated on drawings, S4S.
- B. Moisture Content: S-dry or MC19.
- C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
  - 1. Lumber: S4S, No. 2 or Standard Grade.
  - 2. Boards: Standard or No. 3.

**2.03 CONSTRUCTION PANELS**

- A. Structural Plywood at Coping
  - 1. Structural 1 rated.
  - 2. APA rated grade C or better.
  - 3. Manufactured with exterior glue.
- B. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

**2.04 ACCESSORIES**

- A. Fasteners and Anchors:

1. Metal and Finish: Stainless steel for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
2. Fasteners securing pressure treated lumber shall be manufactured for corrosive resistance and exposures associated with pressure treated wood applications.
3. Nails shall not be used at roof edges to fasten rough carpentry, lumber, plywood, etc... Screws, anchors, and/or machine bolts shall be used to secure rough carpentry at roof perimeter edges.

## **2.05 FACTORY WOOD TREATMENT**

- A. Treated Lumber and Plywood: Comply with requirements of AWWA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
  1. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWWA standards.
- B. Preservative Treatment:
  1. Preservative Pressure Treatment of Lumber Above Grade: AWWA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
    - a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
    - b. Treat lumber exposed to weather.
    - c. Treat lumber in contact with roofing, flashing, or waterproofing.
    - d. Treat lumber in contact with masonry or concrete.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION - GENERAL**

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

### **3.02 BLOCKING, NAILERS, AND SUPPORTS**

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- C. Provide the following specific nonstructural framing and blocking:
  1. Cabinets and shelf supports.
  2. Wall brackets.
  3. Handrails.
  4. Grab bars.
  5. Towel and bath accessories.
  6. Wall-mounted door stops.
  7. Chalkboards and marker boards.

### **3.03 ROOF-RELATED CARPENTRY**

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

### **3.04 INSTALLATION OF CONSTRUCTION PANELS**

- A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.

1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
3. Install adjacent boards without gaps.

**3.05 CLEANING**

- A. Waste Disposal: See Section 01 7419 - Construction Waste Management and Disposal.
  1. Comply with applicable regulations.
  2. Do not burn scrap on project site.
  3. Do not burn scraps that have been pressure treated.
  4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

**END OF SECTION**

**SECTION 06 4100**  
**ARCHITECTURAL WOOD CASEWORK**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Specially fabricated cabinet units.
- B. Hardware.

**1.02 RELATED REQUIREMENTS**

- A. Section 12 3600 - Countertops.

**1.03 REFERENCE STANDARDS**

- A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.
- C. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
  - 1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
  - 2. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
- C. Product Data: Provide data for hardware accessories.
- D. Samples: Submit actual sample items of proposed manufacturer's full line of edge banding and decorative laminate colors, patterns and textures.

**1.05 QUALITY ASSURANCE**

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
  - 1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
- B. Quality Certification:
  - 1. Work in this section shall be performed in accordance with the AWI Quality Certification Program.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Protect units from moisture damage.

**1.07 FIELD CONDITIONS**

- A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

**PART 2 PRODUCTS**

**2.01 CABINETS**

- A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Plastic Laminate Faced Cabinets: Custom grade.
- C. Cabinets:
  - 1. Finish - Exposed Exterior Surfaces: Decorative laminate.
  - 2. Finish - Exposed Interior Surfaces: Decorative laminate.
  - 3. Finish - Semi-Exposed Surfaces: Decorative laminate
  - 4. Finish - Concealed Surfaces: Melamine.
  - 5. Door and Drawer Front Edge Profiles: Square edge with thin applied band.

06 4100 Architectural Wood  
Casework

6. Casework Construction Type: Type A - Frameless.
7. Interface Style for Cabinet and Door: Style 1 - Overlay; reveal overlay.
8. Cabinet Design Series: As indicated on drawings.
9. Adjustable Shelf Loading: 50 psf.
10. Cabinet Style: Flush overlay.
11. Cabinet Doors and Drawer Fronts: Flush style.
12. Drawer Construction Technique: Maple wood with Dovetail joints.

**2.02 WOOD-BASED COMPONENTS**

- A. Wood fabricated from old growth timber is not permitted.

**2.03 LAMINATE MATERIALS**

- A. Manufacturers:
1. Formica Corporation: [www.formica.com/#sle](http://www.formica.com/#sle).
  2. Panolam Industries International, Inc: [www.panolam.com/#sle](http://www.panolam.com/#sle).
  3. Wilsonart LLC: [www.wilsonart.com/#sle](http://www.wilsonart.com/#sle).
  4. Substitutions: See Section 01 6000 - Product Requirements.
- B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.
- C. Provide specific types as indicated.
1. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, through color, color as selected, finish as selected.
  2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, through color, color as selected, finish as selected.
  3. Cabinet Liner: CLS, 0.020 inch nominal thickness, through color, color as selected, finish as selected.
  4. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

**2.04 COUNTERTOPS**

- A. Countertops: See Section 12 3600.

**2.05 ACCESSORIES**

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Plastic Edge Banding: Extruded PVC, flat shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
1. Color: As selected by Architect from manufacturer's full range of colors, textures & patterns. If Architect does not find an edge banding that is an acceptable match for the selected HPL, provide HPL edge banding at no additional cost to the Owner.
  2. Use at all exposed plywood edges.
  3. Use at all exposed shelf edges.
- C. Grommets: Standard plastic grommets for cut-outs, in color to blend with adjacent surface.

**2.06 HARDWARE**

- A. Countertop Support Brackets: Fixed, L-shaped, face-of-stud mounting.
1. Materials: Steel; T-shape cross-section.
    - a. Finish: Manufacturer's standard, factory-applied, powder coat.
    - b. Color: Black.
- B. Drawer and Door Pulls: "U" shaped wire pull, steel with chrome finish, 4 inch centers.
- C. Keyed Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with satin finish.
- D. Drawer Slides:
1. Type: Full extension with overtravel.
  2. Static Load Capacity: Heavy Duty grade.
  3. Mounting: Side mounted.

06 4100 Architectural Wood  
Casework

4. Features: Provide self closing/stay closed type.
5. Manufacturers:
  - a. Accuride International, Inc: [www accuride.com/#sle](http://www accuride.com/#sle).
  - b. Grass America Inc: [www.grassusa.com/#sle](http://www.grassusa.com/#sle).
  - c. Hettich America, LP: [www.hettich.com/#sle](http://www.hettich.com/#sle).
  - d. Knappe & Vogt Manufacturing Company: [www.knappeandvogt.com/#sle](http://www.knappeandvogt.com/#sle).
  - e. Substitutions: See Section 01 6000 - Product Requirements.
- E. Hinges: European style concealed self-closing type, steel with satin finish.
  1. Manufacturers:
    - a. Blum, Inc: [www.blum.com/#sle](http://www.blum.com/#sle).
    - b. Grass America Inc: [www.grassusa.com/#sle](http://www.grassusa.com/#sle).
    - c. Hettich America, LP: [www.hettich.com/#sle](http://www.hettich.com/#sle).
    - d. Substitutions: See Section 01 6000 - Product Requirements.

## **2.07 FABRICATION**

- A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
- B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
- C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.

### **3.02 INSTALLATION**

- A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.
- B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- C. Use concealed joint fasteners to align and secure adjoining cabinet units.
- D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- E. Secure cabinets to floor using appropriate angles and anchorages.

### **3.03 ADJUSTING**

- A. Test installed work for rigidity and ability to support loads.
- B. Adjust moving or operating parts to function smoothly and correctly.

**END OF SECTION**

**SECTION 06 8316  
FIBERGLASS REINFORCED PANELING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Fiberglass reinforced plastic panels.
- B. Trim.

**1.02 REFERENCE STANDARDS**

- A. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels; 2022.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

**1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

**1.04 DELIVERY, STORAGE, AND HANDLING**

- A. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Fiberglass Reinforced Plastic Panels:
  - 1. Crane Composites, Inc: [www.cranecomposites.com/#sle](http://www.cranecomposites.com/#sle).
  - 2. Marlite, Inc: [www.marlite.com/#sle](http://www.marlite.com/#sle).
  - 3. Nudo Products, Inc: [www.nudo.com/#sle](http://www.nudo.com/#sle).
  - 4. Panolam Industries International, Inc: [www.panolam.com/#sle](http://www.panolam.com/#sle).
  - 5. Substitutions: See Section 01 6000 - Product Requirements.

**2.02 PANEL SYSTEMS**

- A. Wall Panels:
  - 1. Panel Size: 4 by 8 feet.
  - 2. Panel Thickness: 0.10 inch.
  - 3. Surface Design: Embossed.
  - 4. Color: White.
  - 5. Attachment Method: Adhesive only, with trim and sealant in joints.

**2.03 MATERIALS**

- A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.
  - 1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.
- B. Trim: Vinyl; color coordinating with panel.
- C. Adhesive: Type recommended by panel manufacturer.
- D. Sealant: Type recommended by panel manufacturer; white.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify existing conditions and substrate flatness before starting work.
- B. Verify that substrate conditions are ready to receive the work of this section.

06 8316 Fiberglass Reinforced  
Paneling

**3.02 INSTALLATION - WALLS**

- A. Install panels in accordance with manufacturer's instructions.
- B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.
- C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.
- D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.
- E. Install panels with manufacturer's recommended gap for panel field and corner joints.
- F. Place trim on panel before fastening edges, as required.
- G. Fill channels in trim with sealant before attaching to panel.
- H. Install trim with adhesive and screws or nails, as required.
- I. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.
- J. Remove excess sealant after paneling is installed and prior to curing.

**END OF SECTION**



**SECTION 07 2100  
THERMAL INSULATION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Board insulation at cavity wall construction, perimeter foundation wall, over roof deck, over roof sheathing, and exterior wall behind metal panel or brick veneer wall finish.
- B. Batt insulation in exterior wall construction.
- C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

**1.02 RELATED REQUIREMENTS**

**1.03 REFERENCE STANDARDS**

- A. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2017).
- B. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.
- C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).
- D. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2023.
- E. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2023a.
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- G. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2024.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

**1.05 FIELD CONDITIONS**

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

**PART 2 PRODUCTS**

**2.01 APPLICATIONS**

- A. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.
- B. Insulation Inside Masonry Cavity Walls: Extruded polystyrene (XPS) board.
- C. Insulation in Metal Framed Walls: Batt insulation with no vapor retarder.
- D. Insulation over Roof Deck: Polyisocyanurate board.

**2.02 FOAM BOARD INSULATION MATERIALS**

- A. Extruded Polystyrene (XPS) Board Insulation: Comply with ASTM C578 with natural skin surfaces.
  - 1. Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum.
  - 2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
  - 3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.

4. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88), minimum, per 1 inch thickness at 75 degrees F mean temperature.
  5. Board Edges: Square.
  6. Board Thickness: 2 inch.
  7. Type and Water Absorption: Type IV, 0.3 percent by volume, maximum, by total immersion.
  8. Products:
    - a. DuPont de Nemours, Inc; Styrofoam Brand Square Edge: [building.dupont.com/#sle](http://building.dupont.com/#sle).
    - b. Kingspan Insulation LLC; GreenGuard XPS Type IV, 25psi: [www.kingspan.com/#sle](http://www.kingspan.com/#sle).
    - c. Owens Corning Corporation; Formular Extruded Polystyrene (XPS) Insulation: [www.ocbuildingspec.com](http://www.ocbuildingspec.com): [www.ocbuildingspec.com/#sle](http://www.ocbuildingspec.com/#sle).
    - d. Substitutions: See Section 01 6000 - Product Requirements.
- B. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, comply with ASTM C1289.
1. Classifications:
    - a. Type II: Faced with either cellulosic facers or glass fiber mat facers on both major surfaces of the core foam.
      - 1) Class 1 - Faced with glass fiber reinforced cellulosic facers on both major surfaces of core foam.
      - 2) Compressive Strength: Classes 1-2-3, Grade 2 - 20 psi (138 kPa), minimum.
      - 3) Thermal Resistance, R-value: At 1-1/2 inch thick; Class 1, Grades 1-2-3 - 8.4 (1.48), minimum, at 75 degrees F.
  2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
  3. Board Size: 48 inch by 96 inch.
  4. Board Thickness:
    - a. Roof Surfaces: R-25 minimum, 4.5 inches total; one layer of 2 inch and one layer of 2-1/2 inch.
    - b. Vertical Surfaces: R-11 minimum, one layer of 2 inch.
  5. Tapered Board: Slope as indicated; minimum thickness 1/2 inch; fabricate of fewest layers possible.
  6. Board Edges: Square.
  7. Products:
    - a. Carlisle Coatings & Waterproofing, Inc; R2+ Matte: [www.carlisleccw.com/#sle](http://www.carlisleccw.com/#sle).
    - b. GAF; EnergyGuard Polyiso Insulation: [www.gaf.com/#sle](http://www.gaf.com/#sle).
    - c. Versico Roofing Systems; VeriCore: [www.versico.com](http://www.versico.com)
    - d. Substitutions: See Section 01 6000 - Product Requirements.

### 2.03 MINERAL FIBER BOARD INSULATION MATERIALS

- A. Mineral Wool Block and Board Thermal Insulation: Complying with ASTM C612.
1. Facing: None, unfaced.
  2. Flame Spread Index: 25 or less, when tested with facing, if any, in accordance with ASTM E84.
  3. Smoke Developed Index: 50 or less, when tested with facing, if any, in accordance with ASTM E84.
  4. Board Size: Rigid mineral wool board insulation is available in a range of sizes from various manufacturers. The work includes installation behind metal wall panels and brick veneer. Insulation behind brick veneer shall be sized to fit between brick ties located at 16" o.c. If Contractor bids insulation from manufacturers that do not offer boards in sizes matching brick tie spacing, bids shall include labor required to cut insulation boards to the correct size.
  5. Board Thickness: 2 inches.
  6. Board Edges: Square.
  7. Thermal Resistance: R-Value of 8.4.
  8. Products:
    - a. Johns Manville; CladStone 80: [www.jm.com/#sle](http://www.jm.com/#sle).

- b. Owens Corning Corporation; Thermafiber Rainbarrier CI High Compressive (80): [www.ocbuildingspec.com/#sle](http://www.ocbuildingspec.com/#sle).
- c. ROCKWOOL; COMFORTBOARD 80: [www.rockwool.com/#sle](http://www.rockwool.com/#sle).
- d. Substitutions: See Section 01 6000 - Product Requirements.

## **2.04 MINERAL FIBER BLANKET INSULATION MATERIALS**

- A. Flexible Glass Fiber Blanket Thermal Insulation: Preformed insulation, complying with ASTM C665; friction fit.
  - 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
  - 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
  - 3. Combustibility: Non-combustible, when tested in accordance with ASTM E136.
  - 4. Thermal Resistance: R-value of 13 minimum.
  - 5. Thickness: Match thickness of stud.
  - 6. Products:
    - a. CertainTeed Corporation: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
    - b. Johns Manville: [www.jm.com/#sle](http://www.jm.com/#sle).
    - c. Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation: [www.ocbuildingspec.com/#sle](http://www.ocbuildingspec.com/#sle).
    - d. Substitutions: See Section 01 6000 - Product Requirements.
- B. Mineral Wool Blanket Thermal Insulation: Flexible or semi-rigid preformed insulation, complying with ASTM C665.
  - 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
  - 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
  - 3. Thermal Resistance: R-value of 13 minimum.
  - 4. Thickness: Match thickness of stud.
  - 5. Products:
    - a. Johns Manville: [www.jm.com/#sle](http://www.jm.com/#sle).
    - b. ROCKWOOL: [www.rockwool.com/#sle](http://www.rockwool.com/#sle).
    - c. Thermafiber, Inc: [www.thermafiber.com/#sle](http://www.thermafiber.com/#sle).
    - d. Substitutions: See Section 01 6000 - Product Requirements.

## **2.05 ACCESSORIES**

- A. Adhesive: Gun grade, interior and exterior, and compatible with insulation and substrates; complies with ASTM C557.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

### **3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER**

- A. Apply adhesive to back of boards:
  - 1. Three continuous beads per board length.
- B. Install boards horizontally on foundation perimeter.
  - 1. Place boards to maximize adhesive contact.
  - 2. Butt edges and ends tightly to adjacent boards and to protrusions.
- C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

### **3.03 BOARD INSTALLATION AT EXTERIOR WALLS**

- A. Install boards horizontally on walls.
  - 1. Install in running bond pattern.
  - 2. Butt edges and ends tightly to adjacent boards and protrusions.

- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

### **3.04 BOARD INSTALLATION AT CAVITY WALLS**

- A. Install boards to fit snugly between wall ties.
- B. Install boards horizontally on walls.
  - 1. Install in running bond pattern.
  - 2. Butt edges and ends tightly to adjacent boards and protrusions.
- C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

### **3.05 BOARD INSTALLATION OVER LOW SLOPE ROOF DECK**

- A. Board Installation Over Roof Deck, General:
  - 1. See applicable roofing specification section for specific board installation requirements.
  - 2. Fasten insulation to deck in accordance with roofing manufacturer's written instructions and applicable Factory Mutual requirements.
  - 3. Do not apply more insulation than can be covered with roofing on the same day.

### **3.06 BATT INSTALLATION**

- A. Install insulation in accordance with manufacturer's instructions.
- B. Install in exterior wall spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

### **3.07 PROTECTION**

- A. Do not permit installed insulation to be damaged prior to its concealment.

**END OF SECTION**

**SECTION 07 2500  
WEATHER BARRIERS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Water-resistive barriers.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 2100 - Thermal Insulation: Weather barrier installed in conjunction with batt insulation.
- B. Section 07 6200 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with weather barriers.

**1.03 DEFINITIONS**

- A. Weather Barriers: Materials or assemblies forming water-resistive barriers, air barriers, vapor retarders, or combination of one or more assemblies.
- B. Water-Resistive Barriers: Materials or assemblies installed behind exterior wall coverings; designed to prevent liquid water from further penetration into exterior wall assembly.

**1.04 REFERENCE STANDARDS**

- A. ASTM D5590 - Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement by Accelerated Four-Week Agar Plate Assay; 2017 (Reapproved 2021).
- B. ASTM E2357 - Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies; 2024.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- D. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.
- E. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.
- F. ICC-ES AC212 - Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers over Exterior Sheathing; 2015, with Editorial Revision (2020).

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on material characteristics, performance criteria, and limitations.
- C. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

**1.06 MOCK-UPS**

- A. Construct weather barrier mock-up, 6 feet long by 4 feet wide, indicating thickness, compatibility with flashings, and terminations.
- B. Locate on sample wall panel.

**1.07 FIELD CONDITIONS**

- A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

**PART 2 PRODUCTS**

**2.01 WATER-RESISTIVE BARRIERS**

- A. Description: Materials installed behind exterior wall coverings; designed to prevent liquid water from further penetration into exterior wall assembly. Primary materials include fluid-applied coatings; accessory materials include flashings and seam tapes.

- B. Water-Resistive Barrier Coating: Fluid-applied air and water-resistive coating for various exterior substrates; vapor permeable.
  - 1. Air Permeance, Building Assembly Air Leakage Rate: Not greater than 0.04 cfm/sq ft when tested at 1.57 psf in accordance with ASTM E2357.
  - 2. Air Permeance, Building Material Air Leakage Rate: 0.004 cfm/sq ft maximum leakage when tested at 1.57 psf pressure difference in accordance with ASTM E2178.
  - 3. Water-Resistive Barrier over Sheathing Compliance: Complying with ICC-ES AC212.
  - 4. Water Vapor Permeance: Tested in accordance with ASTM E96/E96M.
    - a. Procedure B: Greater than 18 perms.
  - 5. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 120 days of weather exposure.
  - 6. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, Class A when tested in accordance with ASTM E84.
  - 7. Resistance to Fungal Growth: No growth when tested in accordance with ASTM D5590.
  - 8. System Accessory Products: As recommended by coating manufacturer.
  - 9. Products:
    - a. PROSOCO, Inc; R-Guard Cat 5: [www.prosoco.com/#sle](http://www.prosoco.com/#sle).
    - b. Henry, a Carlisle Company; Air-Block 17MR: [www.henry.com](http://www.henry.com).
    - c. Sto Corp; Sto Gold Coat: [www.stocorp.com/#sle](http://www.stocorp.com/#sle).

## **2.02 ACCESSORIES**

- A. Seal and Perimeter Tapes: As recommended by water-resistive barrier manufacturer.
- B. Flashings and Sealants: As recommended by water-resistive barrier manufacturer for application.
- C. Building Insulation: See Section 07 2100.
- D. Metal Flashings: See Section 07 6200.
- E. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrates and weather barrier materials.
  - 1. Application: Apply at 30 to 40 mil, 0.030 to 0.040 inch nominal thickness.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that surfaces and conditions comply with requirements of this section.

### **3.02 PREPARATION**

- A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

### **3.03 INSTALLATION**

- A. Install materials in accordance with manufacturer's installation instructions.
- B. Install continuous water-resistive barriers where indicated on drawings, with sheets lapped to shed water.
- C. Apply sealants within recommended temperature range in accordance with manufacturer's installation instructions.
- D. Fluid-Applied Membranes:
  - 1. Prepare substrate in accordance with coating manufacturer's installation instructions; treat joints in substrate and between dissimilar materials as indicated.
  - 2. Where exterior masonry veneer is being applied, install masonry anchors prior to placement of water-resistive barrier over masonry substrate; seal airtight around anchors.
  - 3. Apply bead or trowel coat of mastic sealant with minimum thickness of 1/4 inch along coating seams, rough cuts, and as recommended by manufacturer.
  - 4. Apply flashing to seal with adjacent construction and to bridge joints in coating substrate.
- E. Openings and Penetrations in Exterior Water-Resistive Barriers:

1. Install flashing over sills, covering entire sill framing member, and extend at least 5 inches onto water-resistive barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
2. At openings filled with nonflanged frames, seal water-resistive barrier to each side of framing at opening using flashing at least 9 inches wide, and covering entire depth of framing.
3. At head of openings, install flashing under water-resistive barrier extending at least 2 inches beyond face of jambs; seal water-resistive barrier to flashing.
4. At interior face of openings, seal gaps between window and door frames and rough framing using appropriate joint sealant over backer rod.
5. Service and Other Penetrations: Form flashing around penetrating items and seal to surface of water-resistive barrier.

**3.04 FIELD QUALITY CONTROL**

- A. See Section 01 4000 - Quality Requirements for additional requirements.
- B. Do not cover installed water-resistive barriers until architect has observed completed system.

**3.05 PROTECTION**

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.

**END OF SECTION**

**SECTION 07 4213  
METAL WALL PANELS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Manufactured metal panels for exterior wall panels, soffit panels, retrofit panels, and subgirt framing assembly, with insulation, related flashings, and accessory components.

**1.02 RELATED REQUIREMENTS**

- A. Section 05 4000 - Cold-Formed Metal Framing: Wall panel substrate.
- B. Section 07 2100 - Thermal Insulation.
- C. Section 07 2500 - Weather Barriers: Weather barrier under wall panels.
- D. Section 07 9200 - Joint Sealants: Sealing joints between metal wall panel system and adjacent construction.
- E. Section 09 2116 - Gypsum Board Assemblies: Wall panel substrate.

**1.03 REFERENCE STANDARDS**

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- B. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2023.
- C. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data - Wall System: Manufacturer's data sheets on each product to be used, including:
  - 1. Physical characteristics of components shown on shop drawings.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation instructions and recommendations.
- C. Shop Drawings: Indicate dimensions, layout, joints, construction details, support clips, and methods of anchorage.
- D. Samples: Submit one samples of wall panel and soffit panel, 12 inches by 12 inches in size illustrating finish color, sheen, and texture.
- E. Installer's qualification statement.

**1.05 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in installing products specified in this section with minimum three years of documented experience.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
- B. Store prefinished material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.
- C. Prevent contact with materials that may cause discoloration or staining of products.

**1.07 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Finish Warranty: Provide 15-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.



- C. Special Warranty: Provide 2-year warranty covering water tightness and integrity of seals of metal wall panels. Complete forms in Owner's name and register with warrantor.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Metal Wall Panels - Concealed Clip Fasteners:
1. Petersen Aluminum Corporation; Precision Series Highline S1 Wall Panels: [www.pac-clad.com/#sle](http://www.pac-clad.com/#sle).
  2. Dimensional Metals, Inc; HWPB12: [www.dmimentals.com](http://www.dmimentals.com).
  3. IMETCO; LW-2: [www.imetco.com](http://www.imetco.com)
  4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Metal Soffit Panels:
1. Petersen Aluminum Corporation; Flush Soffit: [www.pac-clad.com/#sle](http://www.pac-clad.com/#sle).
  2. Dimensional Metals, Inc; Flush Panel FP10: [www.dmimentals.com](http://www.dmimentals.com).
  3. IMETCO; FW Series: [www.imetco.com](http://www.imetco.com)

### **2.02 METAL WALL PANEL SYSTEM**

- A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled.
1. Provide exterior wall panels, soffit panels, and subgirt framing assembly.
  2. Design and size components to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of wall.
  3. Design Pressure: In accordance with structural drawings.
  4. Maximum Allowable Deflection of Panel:  $L/180$  for length(L) of span.
  5. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
  6. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
  7. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths, minum length 30 feet.
- B. Exterior Wall Panels; Solid Panels Used at Enclosed Portions of the Building:
1. Profile: Horizontal; style as indicated.
  2. Side Seams: Double-interlocked, tight-fitting.
  3. Material: Precoated steel sheet, 24 gauge, .024 inch minimum thickness.
  4. Panel Width: 12 inches.
  5. Penel Depth: +/- 1 inch.
  6. Color: As selected by Architect from manufacturer's full line.
- C. Exterior Wall Panels, Perforated Panels where Indicated on Drawings:
1. Profile: Horizontal; style as indicated.
  2. Side Seams: Double-interlocked, tight-fitting.
  3. Material: Anodized aluminum sheet, 18 gauge, 0.040 inch minimum thickness.
  4. Panel Width: [12] inches.
  5. Panel Depth; +/- 1 inch.
  6. Perforation: Pattern 1/4 inch round openings at 3/8 inch O.C. staggered, 40% openness or similar.
  7. Color: Clear anodized finish.
- D. Soffit Panels:
1. Profile: Style as indicated, with venting not provided.
  2. Material: Precoated steel sheet, 24 gauge, .024 inch minimum thickness.
  3. Color: As selected by Architect from manufacturer's full line.
  4. Size: 12 inch wide x 1 inch deep.
- E. Subgirt Framing Assembly:

1. 16 gauge, 0.0598 inch thick formed CP60 coated steel sheet.
  2. Profile as indicated; to attach panel system to building.
- F. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; brake formed to required angles as shown on drawings.
- G. Expansion Joints: Same material, thickness and finish as exterior sheets; manufacturer's standard brake formed type, of profile as detailed.
- H. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles.
- I. Anchors: Galvanized steel.

### **2.03 MATERIALS**

- A. Precoated Steel Sheet: Aluminum-zinc alloy-coated steel sheet, ASTM A792/A792M, Commercial Steel (CS)) or Forming Steel (FS), with AZ50/AZM150 coating; continuous-coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.
- B. Anodized Aluminum Sheet: ASTM B209/B209M, with smooth surface texture; Class I Natural Anodized Finish.

### **2.04 FINISHES**

- A. Fluoropolymer Coil Coating System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of coil coated metal surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch; color and gloss as selected by Architect from manufacturer's full line.
- B. Anodized Aluminum Finish: Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

### **2.05 ACCESSORIES**

- A. Concealed clips to attach wall panel system to furring channels. This allows for thermal expansion and contraction of panels without undue wear on fastener.
- B. Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant.
- C. Concealed Sealants: Non-curing butyl sealant or tape sealant, see Section 07 9200
- D. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
- E. Field Touch-up Paint: As recommended by panel manufacturer.
- F. Bituminous Paint: Asphalt base.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that building framing members are ready to receive panels.
- B. Verify weather barrier, see Section 07 2500, has been installed over wall panel substrate; see Section 05 4000.

### **3.02 PREPARATION**

- A. Install subgirts perpendicular to panel length, securely fastened to substrates and shimmed and leveled to uniform plane, and spaced at intervals indicated.

### **3.03 INSTALLATION**

- A. Install panels on walls and soffits in accordance with manufacturer's instructions.
- B. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint; allow to dry prior to wall panel installation.
- C. Fasten panels to structural supports; aligned, level, and plumb.

- D. Locate joints over supports.
- E. Provide expansion and control joints where indicated.
- F. Use concealed fasteners unless otherwise indicated by Architect.
- G. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

**3.04 TOLERANCES**

- A. Offset From True Alignment Between Adjacent Members Abutting or In Line: 1/16 inch, maximum.
- B. Variation from Plane or Location As Indicated on Drawings: 1/4 inch, maximum.

**3.05 CLEANING**

- A. Remove site cuttings from finish surfaces.
- B. Remove protective material from wall panel surfaces.
- C. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

**3.06 PROTECTION**

- A. Protect metal wall panels until completion of project.
- B. Touch-up, repair, or replace damaged wall panels or accessories before Date of Final Completion.

**END OF SECTION**

**SECTION 07 5400  
THERMOPLASTIC MEMBRANE ROOFING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Adhered system with thermoplastic roofing membrane.
- B. Cover boards.
- C. Flashings.
- D. Roofing cant strips, stack boots, and walkway pads.

**1.02 RELATED REQUIREMENTS**

- A. Section 05 3100 - Steel Decking: Placement of acoustical insulation for deck flutes.
- B. Section 06 1000 - Rough Carpentry: Wood cant strips.
- C. Section 07 7100 - Roof Specialties: Prefabricated roofing expansion joint flashing.

**1.03 REFERENCE STANDARDS**

- A. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.
- B. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2023a.
- C. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin-Based Sheet Roofing; 2021.
- D. NRCA (RM) - The NRCA Roofing Manual; 2024.
- E. NRCA (WM) - The NRCA Waterproofing Manual; 2021.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene one week before starting work of this section.
  - 1. Review preparation and installation procedures and coordinating and scheduling required with related work.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data indicating membrane materials, flashing materials, surfacing, and fasteners.
- C. Shop Drawings: Submit drawings that indicate joint or termination detail conditions, conditions of interface with other materials, and mechanical fastener layout.
- D. Samples for Verification: Submit two samples 4 by 4 inches in size illustrating colored coating.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Manufacturer's Installation Instructions: Indicate membrane seaming precautions, special procedures, and perimeter conditions requiring special attention.
- G. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures, humidity, and supplementary instructions given.
- H. Manufacturer's qualification statement.
- I. Installer's qualification statement.
- J. Specimen Warranty: For approval.
- K. Warranty Documentation:
  - 1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

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2. Submit installer's written verification that installation complies with warranty conditions for waterproof membrane.

**1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum Five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of this section with at least Five years of documented experience.

**1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact, unless otherwise indicated.
- B. Store materials in weather protected environment, clear of ground and moisture.
- C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.
- D. Protect foam insulation from direct exposure to sunlight.

**1.08 FIELD CONDITIONS**

- A. Do not apply roofing membrane during unsuitable weather.
- B. Do not apply roofing membrane when ambient temperature is below 40 degrees F or above 90 degrees F.
- C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- E. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

**1.09 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. The Contractor (Roofing System Insaller) shall warrant the materials and workmanship of the roofing system against leakage and against defects due to faulty materials, workmanship and contractor negligence for a period of two (2) years following acceptance of the project by the owner
- C. Material Warranty: Provide membrane manufacturer's warranty agreeing to replace material that shows manufacturing defects within five years after installation.
- D. System Warranty: Provide manufacturer's system warranty agreeing to repair or replace roofing that leaks or is damaged due to wind or other natural causes.
  1. Warranty Term: 20 years.
  2. For repair and replacement include costs of both material and labor in warranty.
  3. Exceptions are not Permitted:
    - a. Damage due to wind speed greater than 56 miles per hour but less than 90 miles per hour.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Thermoplastic Polyolefin (TPO) Membrane Roofing Materials:
  1. Carlisle SynTec Systems; FleeceBACK TPO Adhered: [www.carlisle-syntec.com/#sle](http://www.carlisle-syntec.com/#sle).
  2. GAF; EverGuard Fleece Back TPO 60 mil: [www.gaf.com/#sle](http://www.gaf.com/#sle).
  3. Versico Roofing Systems; VersiFleece TPO: [www.versico.com/#sle](http://www.versico.com/#sle).
  4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Insulation:

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1. See Section 07 2100 - Thermal Insulation

**2.02 ROOFING**

- A. Thermoplastic Membrane Roofing: One ply membrane, fully adhered, over insulation and cover board.

**2.03 MEMBRANE ROOFING AND ASSOCIATED MATERIALS**

- A. Membrane Roofing Materials:
  1. TPO: Thermoplastic polyolefin (TPO) complying with ASTM D6878/D6878M, sheet contains reinforcing fabrics or scrim.
    - a. Thickness: 60 mil, 0.060 inch, minimum.
  2. Sheet Width:
    - a. Adhered Application: Limit width to 120 inches, maximum, when ambient temperatures are less than 40 degrees F for extended period of time during installation.
  3. Color: White for field of low roof and Gray for the high roofs (lobby & apparatus bay).
- B. Seaming Materials: As recommended by membrane manufacturer.
- C. Flexible Flashing Material: Same material as membrane.
- D. TPO-Clad Metal Flashing Material: Minimum 24 gauge sheet steel, minimum A50 zinc aluminum coating with 70% PVDF finish, clad with factory-applied roofing membrane material. Architect to select color from manufacturer's standard range of colors.

**2.04 COVER BOARDS**

- A. Cover Boards: Glass-mat faced gypsum panels complying with ASTM C1177/C1177M.
  1. Thickness: 5/8 inch, Type X, fire-resistant.
  2. Products:
    - a. Georgia-Pacific; DensDeck Prime with EONIC Technology: [www.densdeck.com/#sle](http://www.densdeck.com/#sle).
    - b. Gold Bond Building Products, LLC provided by National Gypsum Company; DEXcell FA Glass Mat Roof Board: [www.goldbondbuilding.com/#sle](http://www.goldbondbuilding.com/#sle).
    - c. USG; Securock Gypsum-Fiber Roof Board: [www.usg.com](http://www.usg.com)
    - d. Substitutions: See Section 01 6000 - Product Requirements.

**2.05 INSULATION**

- A. Polyisocyanurate (ISO) Board Insulation: See Section 07 2100 - Thermal Insulation.

**2.06 ACCESSORIES**

- A. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.
- B. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.
  1. Length as required for thickness of insulation material and penetration of deck substrate, with metal washers.
- C. Membrane Adhesive: As recommended by membrane manufacturer.
- D. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.
- E. Thinners and Cleaners: As recommended by adhesive manufacturer, compatible with membrane.
- F. Insulation Adhesive: As recommended by insulation manufacturer.
- G. Sealants: As recommended by membrane manufacturer.
- H. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.
  1. Composition: Roofing membrane manufacturer's standard.
  2. Surface Color: White or Yellow.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that surfaces and site conditions are ready to receive work.
- B. Verify deck is supported and secure.
- C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.
- D. Verify deck surfaces are dry and free of snow or ice.
- E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

### **3.02 PREPARATION - METAL DECK**

- A. Install preformed acoustical glass fiber insulation strips in roof deck flutes in accordance with manufacturer's instructions; see Section 05 3100.

### **3.03 INSTALLATION, GENERAL**

- A. Perform work in accordance with manufacturer's instructions, NRCA (RM), and NRCA (WM) applicable requirements.
- B. Do not apply roofing membrane during cold or wet weather conditions.
- C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.
- D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- F. Coordinate this work with installation of associated counterflashings installed by other sections as the work of this section proceeds.

### **3.04 INSTALLATION - INSULATION, UNDER MEMBRANE**

- A. Attachment of Insulation: Embed insulation in adhesive in full contact, in accordance with roofing and insulation manufacturers' instructions.
- B. Cover Boards: Mechanically fasten cover boards in accordance with roofing manufacturer's instructions.
- C. Lay subsequent layers of insulation with joints staggered minimum 6 inches from joints of preceding layer.
- D. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.
- E. On metal deck, place boards parallel to flutes with insulation board edges bearing on deck flutes.
- F. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
- G. At roof drains, use factory-tapered boards to slope down to roof drains over a distance of 18 inches.
- H. Do not install more insulation than can be covered with membrane in same day.

### **3.05 INSTALLATION - MEMBRANE**

- A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.
- B. Shingle joints on sloped substrate in direction of drainage.
- C. Fully Adhered Application: Apply adhesive to substrate at rate recommended by manufacturer. Fully embed membrane in adhesive. Fully adhere one roll before proceeding to adjacent rolls.

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- D. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.
- E. At intersections with vertical surfaces:
  - 1. Extend membrane over cant strips and up a minimum of 8 inches onto vertical surfaces.
  - 2. Fully adhere flexible flashing over membrane and up to nailing strips.
  - 3. Secure flashing to nailing strips at 4 inches on center.
- F. Around roof penetrations, seal flanges and flashings with flexible flashing.
- G. Coordinate installation of roof drains and sumps and related flashings.

**3.06 FIELD QUALITY CONTROL**

- A. See Section 01 4000 - Quality Requirements for additional requirements.
- B. Provide site inspection by roofing and insulation manufacturers during installation of the work and at completion of the roofing system.
- C. Provide copy of roofing and insulation system manufacturers' inspection reports as well as reinspection reports confirming completion of corrective work and acceptance of installation by the manufacturer.

**3.07 CLEANING**

- A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.
- B. Remove bituminous markings from finished surfaces.
- C. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.
- D. Repair or replace defaced or damaged finishes caused by work of this section.

**3.08 PROTECTION**

- A. Protect installed roofing and flashings from construction operations.
- B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

**END OF SECTION**



**SECTION 07 6200**  
**SHEET METAL FLASHING AND TRIM**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Fabricated sheet metal items, including flashings, counterflashings, and exterior penetrations.
- B. Sealants for joints within sheet metal fabrications.

**1.02 RELATED REQUIREMENTS**

**1.03 REFERENCE STANDARDS**

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- D. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2018).
- E. CDA A4050 - Copper in Architecture - Handbook; current edition.
- F. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene one week before starting work of this section.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

**1.06 QUALITY ASSURANCE**

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

**1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

**PART 2 PRODUCTS**

**2.01 SHEET MATERIALS**

- A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24-gauge, 0.0239-inch thick base metal, shop pre-coated with PVDF coating.
  - 1. Polyvinylidene Fluoride (PVDF) Coating: Superior performing organic powder coating, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
  - 2. Color: As selected by Architect from manufacturer's full colors.

**2.02 FABRICATION**

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.
- C. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

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- E. Fabricate corners from one piece with minimum 18-inch long legs; seam for rigidity, seal with sealant.
- F. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

**2.03 FLASHING**

- A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.

**2.04 ACCESSORIES**

- A. Fasteners: Galvanized steel, with soft neoprene washers.
- B. Primer Type: Zinc chromate.
- C. Concealed Sealants: Non-curing butyl sealant.
- D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
- E. Asphalt Roof Cement: ASTM D4586/D4586M, Type I, asbestos-free.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

**3.02 PREPARATION**

- A. Install starter and edge strips, and cleats before starting installation.
- B. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.

**3.03 INSTALLATION**

- A. Comply with drawing details. Install work in this section, and coordinate with work in other sections, to provide finished condition that drains water to the exterior of the building.
- B. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.
- C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- D. Exterior Flashing Receivers: Install in accordance with manufacturer's recommendations, and in proper relationship with adjacent construction, and as follows:
  - 1. Secure receiver at perimeter of wall opening with adhesives or fasteners.
  - 2. Place flashing into receiver channel.
  - 3. Secure flashing with receiver clip.
- E. Seal metal joints watertight.

**3.04 FIELD QUALITY CONTROL**

- A. See Section 01 4000 - Quality Requirements for field inspection requirements.
- B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

**END OF SECTION**

**SECTION 07 7100  
ROOF SPECIALTIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Manufactured roof specialties, including fascias and gravel stops.

**1.02 RELATED REQUIREMENTS**

**1.03 REFERENCE STANDARDS**

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- B. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems; 2022.
- C. NRCA (RM) - The NRCA Roofing Manual; 2024.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.
- C. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work.
- D. Samples: Submit two sets of paint chip samples on metal substrate for color selection.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Roof Edge Flashings and Copings:
  - 1. ATAS International, Inc; Rapid-Lok Extruded Fascia: [www.atas.com/#sle](http://www.atas.com/#sle).
  - 2. Hickman Edge Systems; TerminEdge EX Fascia: [www.hickmanedgesystems.com/#sle](http://www.hickmanedgesystems.com/#sle).
  - 3. Metal-Era Inc; Anchor-Tite: [www.metalera.com/#sle](http://www.metalera.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.

**2.02 COMPONENTS**

- A. Roof Edge Flashings: Factory fabricated to sizes required; corners mitered; concealed fasteners.
  - 1. Configuration: Fascia, and edge securement for roof membrane.
  - 2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test methods RE-1 and RE-2 to positive and negative design wind pressure as defined by applicable local building code and as indicated on drawings.
  - 3. Exposed Face Height: As indicated on drawings.
  - 4. Material: Formed steel sheet, galvanized, 24 gauge, 0.024 inch thick, minimum.
  - 5. Finish: 70 percent polyvinylidene fluoride.
  - 6. Color: As selected by Architect from manufacturer's full range.

**2.03 FINISHES**

- A. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system; color as selected from manufacturers full range.

**2.04 ACCESSORIES**

- A. Sealant for Joints in Linear Components: As recommended by component manufacturer.
- B. Adhesive for Anchoring to Roof Membrane: Compatible with roof membrane and approved by roof membrane manufacturer.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify that deck, curbs, roof membrane, base flashing, and other items affecting work of this Section are in place and positioned correctly.

**3.02 INSTALLATION**

- A. Install components in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.
- B. Seal joints within components when required by component manufacturer.
- C. Anchor components securely.
- D. Coordinate installation of components of this section with installation of roofing membrane and base flashings.
- E. Coordinate installation of sealants and roofing cement with work of this section to ensure water tightness.

**END OF SECTION**

**SECTION 07 8123  
INTUMESCENT FIRE PROTECTION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Thin-film intumescent fire protection.

**1.02 REFERENCE STANDARDS**

- A. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- C. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.

**1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittals procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Performance characteristics and test results.
  - 2. Preparation instructions and recommendations.
  - 3. Storage and handling requirements and recommendations.
  - 4. Installation methods.
- C. Selection Samples: For decorative top coat, color chips representing manufacturer's full range of available colors and sheens.
- D. Manufacturer's qualification statement.
- E. Installer's qualification statement.

**1.04 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company that specializes in manufacturing the type of products specified, with minimum of ten years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials in manufacturer's original, unopened containers with identification labels and testing agency markings intact and legible.
- B. Store products in manufacturer's unopened packaging until ready for installation.
  - 1. Store at temperatures not less than 50 degrees F in dry, protected area.
  - 2. Protect from freezing, and do not store in direct sunlight.
  - 3. Dispose of any materials that have come into contact with contaminants of any kind prior to application.
- C. Dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

**1.06 FIELD CONDITIONS**

- A. Protect areas of application from windblown dust and rain.
- B. Maintain ambient field conditions, such as temperature, humidity, and ventilation, within limits recommended by manufacturer for optimum results. Do not install products under ambient conditions outside manufacturer's absolute limits.
  - 1. Provide temporary enclosures as required to control ambient conditions.
  - 2. Do not apply intumescent fireproofing when ambient temperatures are below 50 degrees F without specific approval from manufacturer.
  - 3. Ensure that relative humidity is between 40 and 60 percent in areas of application.

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4. Provide ventilation in enclosed spaces during application and for not less than 72 hours afterward.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Intumescent Thin-Film Fire Protection for Metal:
  1. FlameOFF Coatings, Inc: [www.flameoffcoatings.com/#sle](http://www.flameoffcoatings.com/#sle).
  2. Hilti, Inc: [www.hilti.com/#sle](http://www.hilti.com/#sle).
  3. International Coatings Group: [www.internationalcoatingsgroup.com/#sle](http://www.internationalcoatingsgroup.com/#sle).
  4. Substitutions: See Section 01 6000 - Product Requirements.

### **2.02 SYSTEM REQUIREMENTS**

- A. Fireproofing: Provide intumescent thin-film fire protection systems tested by an independent testing agency in accordance with ASTM E119 and acceptable to authorities having jurisdiction (AHJ).
- B. Structural Steel Beams: Fire resistance rating of 1 hour; Design Number N640.

### **2.03 MATERIALS**

- A. Fire Resistive Coating System: Thin-film intumescent fire protection system for structural steel.
  1. Surface Burning Characteristics: Class A, flame spread/smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
  2. For Interior Use:
    - a. Direct Impact Resistance: 40 in-lb.
    - b. Abrasion Resistance: 0.005 ounce/1000 cycles, maximum.
    - c. Bond Strength: 631 psi, minimum.
    - d. Durometer Hardness, Type D: 65, minimum, in accordance with ASTM D2240.
    - e. Basis of Design: Hilti, Inc; Fire Finish Steel Protection Spray CFP-SP WB: [www.hilti.com/#sle](http://www.hilti.com/#sle).
    - f. Substitutions: See Section 01 6000 - Product Requirements.
- B. Sealers and Primer: As required by tested and listed assemblies, and recommended by fireproofing manufacturer to suit specific substrate conditions.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Examine substrates to determine if they are in satisfactory condition to receive intumescent fire protection; verify that substrates are clean and free of oil, grease, incompatible primers, or other foreign substances capable of impairing bond to fireproofing system.
- B. Do not begin installation until substrates have been properly prepared.
- C. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### **3.02 PREPARATION**

- A. Thoroughly clean surfaces to receive fireproofing.
- B. Repair substrates to remove surface imperfections that could effect uniformity of texture and thickness of fireproofing system, and remove minor projections and fill voids that could telegraph through finished work.
- C. Cover or otherwise protect other work that might be damaged by fallout or overspray of fireproofing system, and provide temporary enclosures as necessary to confine operations and maintain required ambient field conditions.

### **3.03 APPLICATION**

- A. Comply with manufacturer's instructions for each particular intumescent fire protection system installation application as indicated.
- B. Apply manufacturer's recommended primer to required coating thickness.

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- C. Apply fireproofing to full thickness over entire area of each substrate to be protected.
- D. Apply coats at manufacturer's recommended rate to achieve dry film thickness (DFT) as required for fire resistance ratings designated for each condition.
- E. Apply intumescent fire protection by spraying to maximum extent possible, and as necessary complete coverage by roller application or other method acceptable to manufacturer.

**3.04 PROTECTION**

- A. Protect installed intumescent fire protection from damage due to subsequent construction activities, so fireproofing is without damage or deterioration before Date of Final Completion.
- B. Touch-up, repair or replace damaged products before Date of Final Completion.

**END OF SECTION**

**SECTION 07 8400  
FIRESTOPPING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Firestopping systems.
- B. Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

**1.02 RELATED REQUIREMENTS**

**1.03 REFERENCE STANDARDS**

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
- C. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Manufacturer's qualification statement.
- G. Installer's qualification statement.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section and:
  - 1. Trained by manufacturer.

**1.06 FIELD CONDITIONS**

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Firestopping Manufacturers:
  - 1. 3M Fire Protection Products: [www.3m.com/firestop/#sle](http://www.3m.com/firestop/#sle).
  - 2. A/D Fire Protection Systems Inc: [www.adfire.com/#sle](http://www.adfire.com/#sle).
  - 3. Hilti, Inc: [www.hilti.com/#sle](http://www.hilti.com/#sle).
  - 4. Nelson FireStop Products: [www.nelsonfirestop.com/#sle](http://www.nelsonfirestop.com/#sle).
  - 5. Tremco Commercial Sealants & Waterproofing: [www.tremcosealants.com/#sle](http://www.tremcosealants.com/#sle).
  - 6. Substitutions: See Section 01 6000 - Product Requirements.

**2.02 MATERIALS**

- A. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.
- B. Fire Ratings: Refer to drawings for required systems and ratings.

**2.03 FIRESTOPPING SYSTEMS**

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify openings are ready to receive the work of this section.



**3.02 PREPARATION**

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.

**3.03 INSTALLATION**

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

**3.04 FIELD QUALITY CONTROL**

- A. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

**3.05 CLEANING**

- A. Clean adjacent surfaces of firestopping materials.

**3.06 PROTECTION**

- A. Protect adjacent surfaces from damage by material installation.

**END OF SECTION**

**SECTION 07 9200  
JOINT SEALANTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.

**1.02 RELATED REQUIREMENTS**

**1.03 REFERENCE STANDARDS**

- A. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).
- B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- C. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).
- D. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
  - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
  - 2. List of backing materials approved for use with the specific product.
  - 3. Backing material recommended by sealant manufacturer.
  - 4. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
  - 5. Substrates the product should not be used on.
  - 6. Substrates for which use of primer is required.
  - 7. Sample product warranty.
- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- E. Preinstallation Field Sample: Install up to 3 colors (selected by architect) of sealant 12" long in locations to receive sealant color verification. Request on site selection at least two weeks prior to start of installation.
- F. Executed warranty.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

**1.06 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide 5 year manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Complete forms in Owner's name and register with manufacturer.
- C. Extended Correction Period: Correct defective work within 5 year period commencing on Date of Substantial Completion.

## **PART 2 PRODUCTS**

### **2.01 JOINT SEALANT APPLICATIONS**

- A. Scope:
  - 1. Exterior Joints:
    - a. Seal the following joints:
      - 1) Wall expansion and control joints.
      - 2) Joints between doors, windows, and other frames or adjacent construction.
      - 3) Joints between different exposed materials.
  - 2. Interior Joints:
    - a. Do not seal gaps and openings in gypsum board and suspended ceilings
    - b. Do not seal through-penetrations in sound-rated assemblies that are also fire-rated assemblies.
    - c. Seal the following joints:
      - 1) Joints between door frames and window frames and adjacent construction.
      - 2) In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, and piping penetrations.
      - 3) In sound-rated wall and ceiling assemblies, seal joints between wall assemblies and ceiling assemblies; between wall assemblies and other construction; between ceiling assemblies and other construction.
  - 3. Do Not Seal:
    - a. Intentional weep holes in masonry.
    - b. Joints indicated to be covered with expansion joint cover assemblies.
    - c. Joints where sealant is specified to be furnished and installed by manufacturer of product to be sealed.
    - d. Joints where sealant installation is specified in other sections.
    - e. Joints between suspended ceilings and walls.

### **2.02 JOINT SEALANTS - GENERAL**

- A. Colors: To match or coordinate with adjacent materials, Architect to verify color selections prior to installation. Provide mockups where requested by Architect.

### **2.03 NONSAG JOINT SEALANTS**

- A. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
  - 1. Color: To be selected by Architect.
- B. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
  - 1. Movement Capability: Plus and minus 35 percent, minimum.
  - 2. Color: To be selected by Architect from manufacturer's full range.
  - 3. Products:
    - a. Master Builders Solutions; MasterSeal NP1: [www.master-builders-solutions.com/en-us/#sle](http://www.master-builders-solutions.com/en-us/#sle).
    - b. Sika Corporation; Sikaflex-1a: [www.usa.sika.com/#sle](http://www.usa.sika.com/#sle).
    - c. W. R. Meadows, Inc; POURTHANE NS: [www.wrmeadows.com/#sle](http://www.wrmeadows.com/#sle).
    - d. Substitutions: See Section 01 6000 - Product Requirements.
- C. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, nonstaining, nonbleeding, nonsagging; not intended for exterior use.
  - 1. Color: To be selected by Architect from manufacturer's full range.
- D. Noncuring Butyl Sealant: Solvent-based, single component, nonsag, nonskinning, nonhardening, nonbleeding; nonvapor permeable; intended for fully concealed applications.

### **2.04 SELF-LEVELING JOINT SEALANTS**

- A. Type \_\_\_\_ - Semi-Rigid Self-Leveling Polyurea Joint Filler: Two-component, 100 percent solids; intended for filling cracks and control joints not subject to significant movement; rigid enough to

support concrete edges under traffic.

1. Durometer Hardness, Type A: 75, minimum, after seven days when tested in accordance with ASTM D2240.
2. Color: To be selected by Architect from manufacturer's custom colors.
3. Joint Width, Minimum: 1/8 inch.
4. Joint Width, Maximum: 1/2 inch.
5. Joint Depth: Provide product suitable for joints from 1/8 inch to 1 inch in depth excluding space for backer rod.
6. Products:
  - a. ARDEX Engineered Cements; ARDEX ARDISEAL RAPID PLUS: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
  - b. Euclid Chemical Company; EUCO QWIKjoint UVR: [www.euclidchemical.com/#sle](http://www.euclidchemical.com/#sle).
  - c. Mapei; Mapeiflex Joint Sealant PO 95/100: [www.mapei.com/#sle](http://www.mapei.com/#sle).
  - d. Substitutions: See Section 01 6000 - Product Requirements.

## **2.05 ACCESSORIES**

- A. Sealant Backing Materials, General: Materials placed in joint before applying sealants; assists sealant performance and service life by developing optimum sealant profile and preventing three-sided adhesion; type and size recommended by sealant manufacturer for compatibility with sealant, substrate, and application.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.

### **3.02 PREPARATION**

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

### **3.03 INSTALLATION**

- A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Provide joint sealant installations complying with ASTM C1193.
- C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer.
- D. Install bond breaker backing tape where backer rod cannot be used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
- H. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

**3.04 POST-OCCUPANCY**

- A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width, i.e., at low temperature in thermal cycle. Report failures immediately and repair them.

**END OF SECTION**

**SECTION 08 1113  
HOLLOW METAL DOORS AND FRAMES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Fire-rated hollow metal doors and frames.

**1.02 RELATED REQUIREMENTS**

- A. Section 08 7100 - Door Hardware.
- B. Section 08 8000 - Glazing: Glass for doors and borrowed lites.

**1.03 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ANSI/SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Coatings for Steel Doors and Frames; 2019.
- C. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2022.
- D. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames; 2020.
- E. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.
- F. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2020.
- G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- H. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.
- I. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.
- J. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.
- K. ASTM C476 - Standard Specification for Grout for Masonry; 2023.
- L. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- M. ITS (DIR) - Directory of Listed Products; Current Edition.
- N. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.
- O. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.
- P. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.
- Q. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2023.
- R. UL (DIR) - Online Certifications Directory; Current Edition.
- S. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

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- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
- D. Samples: Submit one samples of metal, 2 by 2 inches in size, showing factory finishes, colors, and surface texture.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
- B. Maintain at project site copies of reference standards relating to installation of products specified.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Hollow Metal Doors and Frames:
  - 1. Technical Glass Products; SteelBuilt Window & Door Systems: [www.tgpamerica.com/#sle](http://www.tgpamerica.com/#sle).
  - 2. Titan Metal Products, Inc; Builders Series 20 - 90 Minute Doors: [www.titanmetalproducts.com/#sle](http://www.titanmetalproducts.com/#sle).
  - 3. SAFTIFIRST, Inc; Builders Series 20 - 45 Minute Doors: [www.safti.com](http://www.safti.com)
  - 4. Substitutions: See Section 01 6000 - Product Requirements.

**2.02 PERFORMANCE REQUIREMENTS**

- A. Requirements for Hollow Metal Doors and Frames:
  - 1. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
  - 2. Accessibility: Comply with ICC A117.1 and ADA Standards.
  - 3. Door Edge Profile: Manufacturers standard for application indicated.
  - 4. Typical Door Face Sheets: Flush.
  - 5. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturer's standard.
  - 6. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvanized) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
    - a. Based on SDI Standards: Provide at least A40/ZF120 (galvanized) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvanized) for corrosive locations.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

**2.03 HOLLOW METAL DOORS**

- A. Fire-Rated Doors:
  - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level 3 - Extra Heavy-duty.
    - b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
    - c. Model 1 - Full Flush.
    - d. Door Face Metal Thickness: 16 gauge, 0.053 inch, minimum.
    - e. Zinc Coating: A60/ZF180 galvanized coating; ASTM A653/A653M.

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2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
3. Provide units listed and labeled by UL (DIR) or ITS (DIR).
  - a. Attach fire rating label to each fire rated unit.
4. Door Thickness: 1-3/4 inches, nominal.
5. Door Finish: Factory finished.

**2.04 HOLLOW METAL FRAMES**

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Frame Finish: Factory finished.
- C. Door Frames, Fire-Rated: Full profile/continuously welded type.
  1. Fire Rating: Same as door, labeled.
  2. Frame Metal Thickness: 16 gauge, 0.053 inch, minimum.
  3. Frame Finish: Factory finished.
- D. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
- E. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.

**2.05 FINISHES**

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.
- B. Factory Finish: Complying with ANSI/SDI A250.3, manufacturer's standard coating.
  1. Color: As selected by Architect from manufacturer's full range.
- C. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15 mil, 0.015 inch dry film thickness (DFT) per coat; provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
  1. Fire-Rated Frames: Comply with fire rating requirements indicated.

**2.06 ACCESSORIES**

- A. Door Window Frames: Door window frames with glazing securely fastened within door opening.
  1. Size: 26 inch wide by 67 inch high.
- B. Glazing: As specified in Section 08 8000, factory installed.
- C. Astragals for Double Doors:
  1. Fire-Rated Doors: Steel, shape as required for fire rating.
- D. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.
- E. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
- F. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

**3.02 PREPARATION**

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.



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**3.03 INSTALLATION**

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Install fire rated units in accordance with NFPA 80.
- C. Coordinate frame anchor placement with wall construction.
- D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- E. Install door hardware as specified in Section 08 7100.
  - 1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.
- F. Comply with glazing installation requirements of Section 08 8000.
- G. Touch up damaged factory finishes.

**3.04 TOLERANCES**

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

**3.05 ADJUSTING**

- A. Adjust for smooth and balanced door movement.

**3.06 SCHEDULE**

- A. Refer to Door and Frame Schedule on the drawings.

**END OF SECTION**

**SECTION 08 1116  
ALUMINUM DOORS AND FRAMES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Aluminum frames.

**1.02 RELATED REQUIREMENTS**

**1.03 REFERENCE STANDARDS**

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- C. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- E. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- F. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's descriptive literature for each type of door and frame; include information on fabrication methods.
- C. Shop Drawings: Include elevations of each opening type.
- D. Verification Samples: one actual piece of product in each finish specified, not less than 6 inches square or 6 inches long for linear components. For finishes subject to color variation, include not less than two samples illustrating extreme range to be anticipated.
- E. Test Report: Certified test reports from qualified independent testing agency indicating doors comply with specified performance requirements.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than five years of documented experience.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver aluminum components in manufacturer's standard protective packaging, palletted, crated, or banded together.
- B. Inspect delivered components for damage and replace. Repaired components will not be accepted.
- C. Store components in clean, dry, indoor area, under cover in manufacturer's packaging until installation.
- D. Protect materials and finish from damage during handling and installation.

**1.07 FIELD CONDITIONS**

- A. Do not begin installation of interior aluminum components until space has been enclosed and ambient thermal conditions are being maintained at levels consistent with final project requirements.

**1.08 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

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Frames

- B. Manufacturer Warranty: Provide 10-year manufacturer warranty for defects in workmanship and materials. Complete forms in Owner's name and register with manufacturer.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Aluminum Frames: Add Alternate
1. Avalon International Aluminum LLC; Eagle Series Door Frames and Sidelights: [www.avalonint.com/#sle](http://www.avalonint.com/#sle).
  2. Wilson Partitions; Snap-On Trim: [www.wilsonpart.com/#sle](http://www.wilsonpart.com/#sle).
  3. Frameworks; Type II: [www.frameworks.com](http://www.frameworks.com).
  4. Raco Interior Products; Solutions II: [www.Racointeriors.com](http://www.Racointeriors.com)

### **2.02 DOORS AND FRAMES**

- A. Aluminum Frames for Doors, Sidelights, or Transoms: Extruded aluminum, non-thermally broken hollow or C-shaped sections; no steel components.
1. Frame Depth: To fit wall thicknesses as indicated on drawings.
  2. Finish: Same as doors.
  3. Weatherstripping: Replaceable pile type; at jambs and head.
- B. Dimensions and Shapes: As indicated on drawings; dimensions indicated are nominal.
1. Provide the following clearances:
    - a. Hinge and Lock Stiles: 1/8 inch.
    - b. Between Meeting Stiles: 1/4 inch.
    - c. At Top Rail and Bottom Rail: 1/8 inch.

### **2.03 COMPONENTS**

- A. Frames: Extruded aluminum shapes, not less than 0.062 inch thick, reinforced at hinge and strike locations.
1. Corner Brackets: Extruded aluminum, fastened with stainless steel screws.
  2. Trim: Extruded aluminum, not less than 0.062 inch thick, removable snap-in type without exposed fasteners.

### **2.04 PERFORMANCE REQUIREMENTS**

- A. Provide door assemblies that have been designed and fabricated in compliance with specified performance requirements.
- B. Acoustical Performance: Sound Transmission Class (STC) of 25, minimum, when tested in accordance with ASTM E90.

### **2.05 MATERIALS**

- A. Aluminum Sheet: ASTM B209/B209M, alloy 5005, temper H14, stretcher leveled.
- B. Extruded Aluminum: ASTM B221 (ASTM B221M), alloy 6063, temper T5, or alloy 6463, temper T5.

### **2.06 FINISHES**

- A. Class I Natural Anodized Finish: Clear anodic coating; AAMA 611 AA-M12C22A41, minimum dry film thickness (DFT) of 0.7 mils, 0.0007 inch.

### **2.07 ACCESSORIES**

- A. Fasteners: Aluminum, non-magnetic stainless steel, or other material warranted by manufacturer as non-corrosive and compatible with aluminum components.
- B. Brackets and Reinforcements: Manufacturer's high-strength aluminum units where feasible, otherwise, non-magnetic stainless steel or steel hot-dip galvanized in compliance with ASTM A123/A123M.
- C. Bituminous Coating: Cold-applied asphaltic mastic, compounded for 30-mil thickness per coat.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that wall surfaces and openings are ready to receive frames and are within tolerances specified in manufacturer's instructions.

#### **3.02 PREPARATION**

- A. Perform cutting, fitting, forming, drilling, and grinding of frames as required for project conditions.
- B. Replace components with damage to exposed finishes.
- C. Separate dissimilar metals to prevent electrolytic action between metals.

#### **3.03 INSTALLATION**

- A. Install doors and frames in accordance with manufacturer's instructions and approved shop drawings.
- B. Set frames plumb, square, level, and aligned to receive doors. Anchor frames to adjacent construction in strict accordance with manufacturer's recommendations and within specified tolerances.
- C. Where aluminum surfaces contact metals other than stainless steel, zinc, or small areas of white bronze, protect from direct contact by painting dissimilar metal with heavy coating of bituminous paint.
- D. Hang doors and adjust hardware to achieve specified clearances and proper door operation.

#### **3.04 PROTECTION**

- A. Protect products of this section from damage caused by subsequent construction until Date of Substantial Completion.
- B. Replace damaged or defective components that cannot be repaired to a condition indistinguishable from undamaged components.

**END OF SECTION**

**SECTION 08 1213  
HOLLOW METAL FRAMES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Non-fire-rated hollow metal frames for non-hollow metal doors.
- B. Fire-rated hollow metal frames for non-hollow metal doors.
- C. Interior glazed borrowed lite frames.

**1.02 RELATED REQUIREMENTS**

- A. Section 08 1416 - Flush Wood Doors: Non-hollow metal door for hollow metal frames.
- B. Section 08 7100 - Door Hardware: Hardware, silencers, and weatherstripping.
- C. Section 08 8000 - Glazing: Glazed borrowed lites.
- D. Section 09 9123 - Interior Painting: Field painting.

**1.03 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2022.
- C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.
- D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2020.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.
- G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.
- H. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.
- I. ASTM C476 - Standard Specification for Grout for Masonry; 2023.
- J. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames; 2016.
- K. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- L. ITS (DIR) - Directory of Listed Products; Current Edition.
- M. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.
- N. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.
- O. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.
- P. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.
- Q. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2023.
- R. UL (DIR) - Online Certifications Directory; Current Edition.
- S. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.

- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced grade standard.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.
- D. Manufacturer's qualification statement.
- E. Installer's qualification statement.

#### **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

#### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Hollow Metal Frames with Integral Casings:
  - 1. Ceco Door, an Assa Abloy Group company; SU Frames: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  - 2. Curries, an Assa Abloy Group company; CM-Series Frames: [www.assaabloydss.com/#sle](http://www.assaabloydss.com/#sle).
  - 3. Steelcraft, an Allegion brand; F-Series: [www.allegion.com/#sle](http://www.allegion.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.

#### **2.02 PERFORMANCE REQUIREMENTS**

- A. Refer to Door and Frame Schedule on the drawings for frame sizes, fire ratings, sound ratings, finishing, door hardware to be installed, and other variations, if any.
- B. Door Frame Type: Provide hollow metal door frames with integral casings.
  - 1. Interior Doors: Use frames with integral casings.
- C. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
- D. Accessibility: Comply with ICC A117.1 and ADA Standards.
- E. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturers standard.
- F. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior frame that is also indicated as being sound-rated must comply with the requirements specified for exterior frames and for sound-rated frames; where two requirements conflict, comply with the most stringent.
- G. Hardware Preparations, Selections and Locations: Comply with BHMA A156.115, NAAMM HMMA 830, NAAMM HMMA 831 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- H. Zinc Coating for Units Subject to Corrosive Conditions: Components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvanized) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise.

#### **2.03 HOLLOW METAL DOOR FRAMES WITH INTEGRAL CASINGS**

- A. Frame Finish: Factory primed and field finished.
- B. Interior Door Frames, Non-Fire Rated: Face welded type.

1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
  - a. Level 3 - Extra Heavy-duty.
  - b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
  - c. Frame Metal Thickness: 16 gauge, 0.053 inch, minimum.
- C. Fire-Rated Door Frames: Face welded type.
  1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level 3 - Extra Heavy-duty.
    - b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
    - c. Frame Metal Thickness: 16 gauge, 0.053 inch, minimum.
  2. Fire Rating: As indicated on Door and Frame Schedule, tested in accordance with UL 10C or NFPA 252 ("positive pressure fire tests").
  3. Provide units listed and labeled by ITS (DIR) or UL (DIR).
    - a. Attach fire rating label to each fire rated unit by means of an indepdant stamped metal tag f

## **2.04 FINISHES**

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.
- B. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15 mil, 0.015 inch dry film thickness (DFT) per coat; provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
  1. Fire-Rated Frames: Comply with fire rating requirements indicated.

## **2.05 ACCESSORIES**

- A. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
- B. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.
- C. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

### **3.02 PREPARATION**

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

### **3.03 INSTALLATION**

- A. Install frames in accordance with manufacturer's instructions and related requirements of specified frame standards or custom guidelines indicated.
- B. Install fire rated units in accordance with NFPA 80.
- C. Coordinate frame anchor placement with wall construction.
- D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- E. Comply with glazing installation requirements of Section 08 8000.
- F. Install door hardware as specified in Section 08 7100 and as shown on the drawings.

**3.04 TOLERANCES**

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. Maximum Diagonal Distortion: 1/16 inch measured with straight edges, crossed corner to corner.

**3.05 SCHEDULE - SEE DRAWINGS**

- A. Refer to Door and Frame Schedule on the drawings.

**END OF SECTION**



**SECTION 08 1416  
FLUSH WOOD DOORS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Flush wood doors; flush configuration; fire-rated, non-rated, and acoustical.

**1.02 RELATED REQUIREMENTS**

- A. Section 08 1213 - Hollow Metal Frames.
- B. Section 08 7100 - Door Hardware.
- C. Section 08 8000 - Glazing.

**1.03 REFERENCE STANDARDS**

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- C. AWI (QCP) - Quality Certification Program; Current Edition.
- D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- E. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.
- F. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
  - 1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
- D. Samples: Submit one sample of door veneers, 4 by 4 inches in size illustrating wood grain, stain color, and sheen.
- E. Manufacturer's Installation Instructions: Indicate special installation instructions.
- F. Warranty, executed in Owner's name.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.
  - 1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
- B. Woodwork Quality Assurance Program:
  - 1. Comply with AWI (QCP) woodwork association quality assurance service/program in accordance with requirements for work specified in this section; [www.awiqcp.org/#sle](http://www.awiqcp.org/#sle).

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging, and inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

**1.07 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

- B. Manufacturer Warranty: Provide manufacturer's warranty on interior doors for the life of the installation. Complete forms in Owner's name and register with manufacturer.
  - 1. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Wood Veneer Faced Doors:
  - 1. Algoma Hardwoods, Inc; Architectural Series: [www.algomahardwoods.com](http://www.algomahardwoods.com)
  - 2. Eggers Industries; Flush Wood Doors: [www.eggersindustries.com](http://www.eggersindustries.com)
  - 3. Graham Wood Doors; Graham Custom Door: [www.grahamdoors.com](http://www.grahamdoors.com)
  - 4. Marshfield Door Systems, Inc; Signature Series: [www.marshfielddoors.com](http://www.marshfielddoors.com).
  - 5. Substitutions: See Section 01 6000 - Product Requirements.

### **2.02 DOORS**

- A. Doors: See drawings for locations and additional requirements.
  - 1. Quality Standard: Custom Grade, Extra Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.
- B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
  - 1. Provide solid core doors at each location.

### **2.03 DOOR AND PANEL CORES**

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.
- B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

### **2.04 DOOR FACINGS**

- A. Veneer Facing for Transparent Finish: White oak, HPVA Grade A, rift cut (only red and white oak), with slip match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.
  - 1. Vertical Edges: Same species as face veneer.
  - 2. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet of each other when doors are closed.

### **2.05 DOOR CONSTRUCTION**

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
  - 1. Provide solid blocks at lock edge for hardware reinforcement.
  - 2. Provide solid blocking for other throughbolted hardware.
- C. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
- D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- F. Provide edge clearances in accordance with the quality standard specified.

### **2.06 FINISHES - WOOD VENEER DOORS**

- A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
  - 1. Transparent:
    - a. System - 11, Polyurethane, Catalyzed.

- b. Stain: As selected by Architect.
- c. Sheen: Satin.

B. Factory finish doors in accordance with approved sample.

## **2.07 ACCESSORIES**

A. Hollow Metal Door Frames: See Section 08 1213.

B. Glazed Openings:

- 1. Heat-Strengthened and Fully Tempered Glass: ASTM C1048.
- 2. Fire-Protection-Rated Glass: Safety Certification, 16 CFR 1201, Category II.
- 3. Tint: Clear.

C. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.

D. Door Hardware: See Section 08 7100.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

### **3.02 INSTALLATION**

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
  - 1. Install fire-rated doors in accordance with NFPA 80 requirements.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.
- E. Coordinate installation of glazing.

### **3.03 TOLERANCES**

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.

### **3.04 ADJUSTING**

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

### **3.05 SCHEDULE**

- A. See Door and Frame Schedule on drawings.

**END OF SECTION**

**SECTION 08 3100  
ACCESS DOORS AND PANELS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Floor-mounted access door and frame units, interior.

**1.02 RELATED REQUIREMENTS**

- A. Section 09 9123 - Interior Painting: Field paint finish.

**1.03 REFERENCE STANDARDS**

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- C. Shop Drawings: Indicate exact position of each access door and/or panel unit.
- D. Manufacturer's Installation Instructions: Indicate installation requirements.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

**PART 2 PRODUCTS**

**2.01 ACCESS DOORS AND PANELS ASSEMBLIES**

- A. Interior Floor-Mounted Access Units:
  - 1. Location: As indicated on drawings.
  - 2. Size: 36 by 36 inches.

**2.02 FLOOR-MOUNTED ACCESS UNITS**

- A. Manufacturers:
  - 1. Activar Construction Products Group, Inc. - JL Industries: [www.activarcpg.com/#sle](http://www.activarcpg.com/#sle).
    - a. Angled Floor Doors: Activar/JL Industries FLDA.
  - 2. ACUDOR Products Inc; FA-300: [www.acudor.com/#sle](http://www.acudor.com/#sle).
  - 3. BILCO Company; Type K - Angle Frame, aluminum: [www.bilco.com/#sle](http://www.bilco.com/#sle).
- B. Floor-Mounted Access Units: Factory fabricated, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
  - 1. Size: As indicated on drawings.
  - 2. Hardware: Steel, hot-dipped galvanized.
    - a. Hinges: Removable pin.
    - b. Lock: Screw driver slot for quarter turn cam lock.
- C. Interior Floor-Mounted Access Units: Aluminum, minimum 1/4 inch thick.
  - 1. Design Load: Design to support live load of 300 psf with deflection not to exceed 1/180 of span.
  - 2. Operation: Manual opening, and manual closing.
  - 3. Cover Pattern: Diamond tread plate.
  - 4. Lift Handle: Recessed, non-removable.
  - 5. Finish: Mill finish.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify that rough openings are correctly sized and located.

08 3100 Access Doors and  
Panels

**3.02 INSTALLATION**

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings, and secure units rigidly in place.
- C. Position units to provide convenient access to concealed equipment when necessary.

**END OF SECTION**

**SECTION 08 3500  
FOLDING DOORS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Four-Fold doors, electrically operated.
- B. Operating hardware and supports.
- C. Electrical controls.

**1.02 RELATED REQUIREMENTS**

**1.03 REFERENCE STANDARDS**

- A. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).
- B. UL (DIR) - Online Certifications Directory; Current Edition.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.
- C. Product Data: Show component construction, anchorage method, and hardware.
- D. Samples: Two panel finish samples, 2 by 2 inch in size, illustrating color and finish.
- E. Manufacturer's Installation Instructions: Include any special procedures required by project conditions.
- F. Manufacturer's qualification statement.
- G. Installer's qualification statement.
- H. Operation Data: Include normal operation, troubleshooting, and adjusting.
- I. Maintenance Data: Include data for motor and transmission, shaft and gearing, lubrication frequency, spare part sources.
- J. Specimen warranty.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years documented experience.
- C. Products Requiring Electrical Connection: Listed and classified by UL (DIR), as suitable for purpose specified.

**1.06 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for warranty requirements.
- B. Extended Correction Period: Correct defective work within a 2-year period commencing on Date of Final Completion.
- C. Manufacturer Warranty: Provide 5-year manufacturer warranty for electric operating equipment. Complete forms in Owner's name and register with manufacturer.

**PART 2 PRODUCTS**

**2.01 PERFORMANCE REQUIREMENTS**

- A. Performance: Withstand positive and negative wind loads equal to 1.5 times design wind loads specified by local code without damage or permanent set, when tested in accordance with ASTM E330/E330M, using 10 second duration of maximum load.

## 2.02 BASIS OF DESIGN - STEEL DOORS

- A. Four-Fold Doors:
  - 1. Basis of Design; Door Engineering and Manufacturing, FF701 Series: [doorengineering.com](http://doorengineering.com).
- B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufactures listed below:
  - 1. International Door, Inc., IDI Storm Commnader MOdel HFF400-SC-DSI; [www.international-door.com](http://www.international-door.com)
  - 2. Jus Doors; [www.jusdoors.us](http://www.jusdoors.us)Schneider; model M93
- C. Substitutions: See Section 01 6000 - Product Requirements.
  - 1. For any product not identified as "Basis of Design", submit information specified for substitution.
- D. Construction: Door framing shall be miniumum 11-guage structural steel tube with 14-guage sheet steel on the exterior and interior faces. Sheeting shall be formed on the verical edges with no visible welds or caulked sheet edges on the interior or exterior panel faces. All frames and framing members shall be true to dimension and square in all directions, and no door shall be bowed, warped, or out of line in the vertical or horizontal plane of the door opening by more than 1/8 inch in 20 feet. Exposed welds and welds which interfere with the installation of various parts shall be ground smooth and flush.
- E. Surface Mounted Tube Frame: Supply pre-hung tube frame system constructed of TS6x6x0.25 inch, designed to anchored to masonry wall construction or weld to steel structure. All hinges, track supports and operator supports shall be factory attached.
- F. Facotry Finish: Operator and operating hardware shall be powdercoated manufacturer's standard gray. Panels, frame and all other hardware shall be finished as follows:
  - 1. All exposed steel shall be finished with manufacturer's standard zinc rich primer and polyurethane top coat, PPG Spectracron or equal.
  - 2. Architect to select from Manufacturer's full range of colors or furnish color to match.
- G. Operating Hardware: Hardware shall include guide tracks and brackets, trollys, center guides, not less than three pairs of jamb and fold hinges per opening, and all bolts, nuts, fasteners, etc. necessary for complete installation and operation. Jamb hinges shall be dual shear and have two thrust bearings and two needle bearings. Jamb hinges shall be gusseted. Fold hinges shall be dual shear with two thrust bearings. Fold hinges shall be stainless steel. All bearings shall be completely sealed within the hing barrel and include grease zerks. All hinge pins shall be minimum 3/4 inch. diameter hardened steel. All trollys shall be equiped with two Nylatron rollers.

## 2.03 COMPONENTS

- A. Sill Weatherstripping: Two 1/16 inch EPDM rubber sweeps with an aluminum retainer. The retainer shall be attached to the door with adhesive.
- B. Jamb Weatherstripping: EPDM rubber seal, one piece full length with no exposed fasteners on the exterior side of the panel.
- C. Head Weatherstripping: EPDM rubber seal, one piece full length with no exposed fasteners on the exterior side of the panel.
- D. Hinge Guards: Provide plastic guards at jamb hinges to prevent access through hinge space.
- E. Hurricane Locking System: Locking bolts shall be completely concealed within the door panel. Locking bolts shall extend into the floor and into the header tube. A limit swtich shall disable the operator when the locks are engaged.

## 2.04 MATERIALS

- A. Steel Tube: ASTM A513 and ASTM A500/A500M.
- B. Sheet Steel: Steel sheets of commercial quality, complying with ASTM A1008 cold-rolled steel sheet.

- C. Hardware: Manufacturer's standard components.
- D. Fasteners: Zinc-coated steel.

## **2.05 ELECTRIC OPERATION**

- A. Each Four-Fold door shall be operated by an overhead mounted electromechanical drive unit designed for high cycle operation. Operator consist of an electronic motor, gear reducer, and rotating drive arm. Teh door shall be operated with connecting rods attached to the rotating drive arm on the operator and to control arms attached to the jamb door section and to the door lintel. The connecting rods shall be positive drive, keeping the door under firm control at all times. The connecting rods shall be fitted with spherical bearings and control arms shall be equipped with oil impregnated bronze bearings on polished shafts.
- B. Operator shall be instantly reversible, open and close rapidly and start and stop gradually. Operator shall be adjustable to allow door to fully clear the opening. Operator shall automatically lock the door in the closed position. Operator shall be equipped with disengaging mechanism to convert to manual operation.
- C. Electric motor shall be of sufficient size to operate doors under normal operating conditions at no more than 75 percent of rated capacity. The motor shall be wound for three phase 208/260/480 VAC, 60 Hertz operation.
- D. Electric Controls: Controls shall be furnished by the door manufacturer and shall be complete for each door, and built in accordance with the latest NEMA standards.
  - 1. Control panel assemblies shall be UL listed as per NFPA70.
  - 2. Controls shall include a programmable logic controller with digital message display. Controller shall include programmable close timers and programmable inputs/outputs.
  - 3. Motor starters shall be magnetic reversing, factory wired with overload and under voltage protection, and equipped with mechanical interlocks. All control components shall be enclosed in one enclosure with a wiring diagram placed on the inside of the cover.
  - 4. Enclosures shall be NEMA 4 with disconnect switch.
  - 5. Pushbuttons (interior) for each door shall have one momentary pressure three-button push-button station marked "OPEN", "CLOSE" and "STOP". Push button enclosure shall be NEMA.
  - 6. Limit switches shall be provided to stop the travel of the door in its fully open or fully closed position.
  - 7. Safety edges: Provide monitored electric safety edges on leadin edge of all doors to reverse door upon contact with obstruction.
  - 8. Photo eyes: Provide (1) exterior, jamb mounted, lght Curtain type photo eyes, Nema 4 rated. Photo eye shall cover from floor level to 72" above floor.
  - 9. Presence Sensor: Provide (1) interior, overhead mounted, pressure sensor BEA IS40P or equal.
- E. Radio controls: Provide one (1) radio receiver and (1) single button remotes per door. Remotes to open and close doors with single button.
- F. Warning Horn/Strobe: Provide warning light and strobe. Include outputs PLC to allow for activation while door is inmotion both opening and closing, along with activation prior to closing. Include programmable "delay-to-close" timer whcih activates the warning horn for a st time, prior to the door closing.
- G. Hand Held Transmitter: Digital control, and resettable.

## **PART 3 EXECUTION**

### **3.01 PREPARATION**

- A. Prepare opening to permit correct installation of door unit to perimeter air and vapor barrier seal.

### **3.02 INSTALLATION**

- A. Install door unit assembly in accordance with manufacturer's instructions.
- B. Anchor assembly to wall construction and building framing without distortion or stress.



- C. Securely brace door tracks. Secure tracks to structural members only.
- D. Fit and align door assembly including hardware.
- E. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.
- F. Install perimeter trim.

**3.03 TOLERANCES**

- A. Maximum Variation from Plumb: 1/16 inch.
- B. Maximum Variation from Level: 1/16 inch.
- C. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch from 10 ft straight edge.
- D. Maintain dimensional tolerances and alignment with adjacent work.

**3.04 ADJUSTING**

- A. Adjust door assembly for smooth operation and full contact with weatherstripping.
- B. Have manufacturer's field representative present to confirm proper operation and identify adjustments to door assembly for specified operation.

**3.05 CLEANING**

- A. Clean doors and frames and glazing.
- B. Remove temporary labels and visible markings.

**3.06 PROTECTION**

- A. Protect installed products from damage until Date of Final Completion.
- B. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

**END OF SECTION**

**SECTION 08 4313  
ALUMINUM-FRAMED STOREFRONTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Aluminum-framed storefront, with vision glass.
- B. Aluminum doors and frames.
- C. Interior light shelves.
- D. Exterior sun shades.
- E. Weatherstripping.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.
- B. Section 08 7100 - Door Hardware: Hardware items other than specified in this section.
- C. Section 08 8000 - Glazing: Glass and glazing accessories.

**1.03 REFERENCE STANDARDS**

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.
- B. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2015.
- C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.
- D. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
- E. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- F. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
- G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
- I. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.
- J. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate with installation of other components that comprise the exterior enclosure.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, and internal drainage details.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.

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1. Include design engineer's stamp or seal on shop drawings for attachments and anchors.
- D. Color Selection Samples: Aluminum finishes specified as clear anodized, provide finish verification samples. Interior light shelves require color selection for infill panels, provide color selection samples of manufacturer's standard colors.
- E. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.
- F. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.
- G. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.
- H. Specimen warranty.

**1.06 QUALITY ASSURANCE**

- A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.
- B. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least five years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of type specified and with at least five years of documented experience.

**1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

**1.08 FIELD CONDITIONS**

- A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

**1.09 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Provide ten year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

**PART 2 PRODUCTS**

**2.01 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING**

- A. Center-Set Style, Thermally-Broken: Exterior
  1. Basis of Design: Kawneer; 451T: [www.kawneer.com](http://www.kawneer.com).
  2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
  3. Glazing: Provide glazing pockets for 1 inch insulated glazing units at exterior locations.
- B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
  1. YKK AP America, Inc.: [www.ykkap.com](http://www.ykkap.com).
  2. EFCO Corporation: [www.efcocorp.com](http://www.efcocorp.com).
- C. Substitutions: See Section 01 6000 - Product Requirements.
  1. For any product not identified as "Basis of Design", submit information as specified for substitutions.

**2.02 BASIS OF DESIGN -- FRAMING FOR MONOLITHIC GLAZING**

- A. Center-Set Style: Interior
  1. Basis of Design: Kawneer; 451; [www.kawneer.com](http://www.kawneer.com).
  2. Vertical Mullion Dimensions: 1-3/4 inches wide by 4-1/2 inches deep.
  3. Glazing: Provide glazing pockets for 1/4 inch monolithic glazing at interior locations.

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- B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
  - 1. YKK AP America, Inc.: [www.ykkap.com](http://www.ykkap.com).
  - 2. EFCO Corporation: [www.efcocorp.com](http://www.efcocorp.com).
- C. Substitutions: See Section 01 6000 - Product Requirements.
  - 1. For any product not identified as "Basis of Design", submit information as specified for substitutions.

**2.03 BASIS OF DESIGN -- SWINGING DOORS**

- A. Wide Stile, Insulated Glazing: Exterior
  - 1. Basis of Design: Kawneer; 500 Insulpour Thermal Entrance: [www.kawneer.com](http://www.kawneer.com). At all exterior locations.
  - 2. Thickness: 2-1/4 inches.
  - 3. Glazing: Provide glazing stops for 1 inch insulated glazing at exterior doors.
- B. Wide Stile, Monolithic Glazing: Interior Vestibule
  - 1. Basis of Design: Kawneer; 500 Standard Entrance: [www.kawneer.com](http://www.kawneer.com).
  - 2. Thickness: 1-3/4 inches.
  - 3. Glazing: Provide glazing stops for 1/4 inch monolithic glazing at interior doors.
- C. Medium Stile, Monolithic Glazing: Interior at Student Lounge
  - 1. Basis of Design: Kawneer; 350 Standard Entrance: [www.kawneer.com](http://www.kawneer.com).
  - 2. Thickness: 1-3/4 inches.
  - 3. Glazing: Provide glazing stops for 1/4 inch monolithic glazing at interior doors.
- D. Flush, Aluminum Skinned: Exterior
  - 1. Basis of Design: Kawneer, Flushline Series, embossed aluminum face sheets with orange peel finish: [www.kawneer.com](http://www.kawneer.com).
  - 2. Thickness 1-3/4 inches.
- E. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
  - 1. YKK AP America, Inc.: [www.ykkap.com](http://www.ykkap.com).
  - 2. EFCO Corporation: [www.efcocorp.com](http://www.efcocorp.com).
- F. Substitutions: See Section 01 6000-Product Requirements.
  - 1. For any product not identified as "Basis of Design", submit information as specified for substitutions.

**2.04 ALUMINUM-FRAMED STOREFRONT**

- A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
  - 1. Glazing Rabbet: For 1 inch insulating glazing.
  - 2. Glazing Rabbet: For 1/4 inch monolithic glazing.
  - 3. Glazing Position: Centered (front to back).
  - 4. Finish: Class I color anodized.
    - a. Factory finish all surfaces that will be exposed in completed assemblies.
    - b. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
  - 5. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
  - 6. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
  - 7. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

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8. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
  9. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
  10. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
- B. Performance Requirements
1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
    - a. Design Wind Loads: Comply with requirements of ASCE 7.
    - b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
    - c. Contractor's option to provide internal steel support or heavier gauge aluminum for exterior storefront at entrance vestibule V1 & V2, Student Lounge 302, Staff Lounge 114, and any other units determined by engineer's calculations during shop drawing preparation.
  2. Air Leakage: 0.06 cfm/sq ft maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf pressure difference.

**2.05 COMPONENTS**

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior where indicated, drainage holes and internal weep drainage system.
1. Glazing Stops: Flush.
- B. Glazing: See Section 08 8000.
- C. Filler Strips: Typical at all windows and door frames, provide storefront manufacturer's continuous polymer filler strips at head and jambs to provide support for backer rod and sealant.
- D. Provide Plastic Shims.

**2.06 BASIS OF DESIGN - INTERIOR LIGHT SHELVES**

- A. Interior Light Shelves: Shop fabricated, shop finished, extruded aluminum frame with 4mm aluminum composite infill panels. Panels shall fold down without the use of tools to allow access for cleaning the tops of panels.
1. Basis of Design - Kawneer, InLighten.
  2. Panels shall fold down without the use of tools to allow access for cleaning the tops of panels.
    - a. Configuration: As indicated on drawings. Provide factory mitered panels at corner windows.
    - b. Size:
      - 1) Width: Match vertical spacing of +/- 36 inches, maximum unit 112 inches wide.
      - 2) Depth: 24 inch projection from inside face of storefront.
    - c. Finishes:
      - 1) Aluminum Frame: Clear Anodized.
      - 2) ACM Infill Panel: Factory Painted.
        - (a) Color selection: Top surface - White. Bottom Surface - Architect to select from manufacturer's standard range.
- B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
1. YKK AP America, Inc.: [www.ykkap.com](http://www.ykkap.com), Luninane

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2. EFCO Corporation: [www.efcocorp.com](http://www.efcocorp.com). Arcadia, Inc, E-Lite
- C. Substitutions: See Section 01 6000-Product Requirements.
  1. For any product not identified as "Basis of Design", submit information as specified for substitutions.

**2.07 BASIS OF DESIGN - EXTERIOR SUN SHADES:**

- A. Sun Shades: Shop Fabricated, Shop Finished, Extruded Aluminum Outriggers, Louvers, and Fascia, Free of Defects Impairing Strength, Durability or Appearance.
  1. Basis of Design - Kawneer, Verisoleil Sunshade - Outrigger System.
  2. Configuration: As indicated on drawings.
  3. Louver type: Arch.
  4. Outrigger Shape: Straight.
  5. Fascia: Rounded
  6. Design Criteria: Design and fabricate to resist the same loads as storefront system as well as the following loads without failure, damage, or permanent deflection:
    - a. Thermal Movement: Plus/minus 1/8 inch, maximum.
  7. Sizes:
    - a. Lengths as indicated on drawings.
    - b. Depth: 30 inch projections from exterior face of storefront.
  8. Shop fabricate to the greatest extent possible, disassemble if necessary for shipping.
- B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
  1. YKK AP America, Inc.: [www.ykkap.com](http://www.ykkap.com), ThermaShade
  2. EFCO Corporation: [www.efcocorp.com](http://www.efcocorp.com). Arcadia, Inc, E-Shade
- C. Substitutions: See Section 01 6000-Product Requirements.
  1. For any product not identified as "Basis of Design", submit information as specified for substitutions.

**2.08 MATERIALS**

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).
- B. Sheet Aluminum: ASTM B209/B209M.
- C. Fasteners: Stainless steel.
- D. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

**2.09 FINISHES**

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.
- B. Infill Panels at Interior Light Shelves: Pigmented Organic Coatings: AAMA 2603; polyester or acrylic baked enamel finish, color as selected by Architect from manufacturer's standard range.

**2.10 HARDWARE**

- A. For each door, include weatherstripping and sill sweep strip.
- B. Other Door Hardware: See Section 08 7100.
- C. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

### **3.02 INSTALLATION**

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- H. Set thresholds in bed of sealant and secure.
- I. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

### **3.03 TOLERANCES**

- A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

### **3.04 FIELD QUALITY CONTROL**

- A. Water-Spray Test: Provide water spray quality test of installed storefront components in accordance with AAMA 501.2 during construction process and before installation of interior finishes.
  - 1. Perform a minimum of two tests in each designated area as indicated on drawings.
  - 2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.

### **3.05 ADJUSTING**

- A. Adjust operating hardware and sash for smooth operation.

### **3.06 CLEANING**

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.

### **3.07 PROTECTION**

- A. Protect installed products from damage until Date of Final Completion.

### **END OF SECTION**

**SECTION 08 5113  
ALUMINUM WINDOWS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Extruded aluminum windows including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of window units to fit into storefront framing system.
- B. Operating hardware.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 2500 - Weather Barriers: Sealing frame to water-resistive barrier installed on adjacent construction.
- B. Section 08 4313 Aluminum-Framed Storefront
- C. Section 08 8000 - Glazing.

**1.03 REFERENCE STANDARDS**

- A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights; 2022.
- B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.
- C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Include component dimensions, information on glass and glazing, internal drainage details, and descriptions of hardware and accessories.
- C. Shop Drawings: Indicate opening dimensions, elevations of different types, framed opening tolerances, anchorage locations, and installation requirements.
- D. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
  - 1. Evidence of AAMA Certification.
  - 2. Evidence of WDMA Certification.
  - 3. Evidence of CSA Certification.
  - 4. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.

**1.05 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.

**PART 2 PRODUCTS**

**2.01 BASIS OF DESIGN - KAWNEER GLASSVENT WINDOWS FOR STOREFRONT FRAMING**

- A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 having Performance Class of P-HC40 - P-HC70 Project-Out Windows. Performance Grade at least as high as specified design pressure.
- B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
  - 1. For any product not identified as "Basis of Design", the window unit must match that of the Storefront. Other acceptable storefront manufacturers:
    - a. YKK AP America, Inc.: [www.ykkap.com](http://www.ykkap.com).
    - b. EFCO Corporation: [www.efcocorp.com](http://www.efcocorp.com).



C. Substitutions: See Section 01 6000 - Product Requirements.

## **2.02 ALUMINUM WINDOWS**

- A. Aluminum Windows: Extruded aluminum frame and sash, factory fabricated, factory finished, with operating hardware, related flashings, and anchorage and attachment devices.
  - 1. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for operating hardware and imposed loads.
  - 2. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
  - 3. Movement: Accommodate movement between window and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
  - 4. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
- B. Outswinging Awning Type:
  - 1. Glazing: Double, see storefront and glazing specifications.
  - 2. Exterior Finish: Glass.
  - 3. Interior Finish: Class I natural anodized.

## **2.03 MATERIALS**

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

## **2.04 HARDWARE**

- A. Sash lock: Lever handle with cam lock.

## **2.05 FINISHES**

- A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41, clear anodic coating not less than 0.7 mil thick.

# **PART 3 EXECUTION**

## **3.01 EXAMINATION**

- A. Verify that wall openings and adjoining water-resistive barrier materials are ready to receive aluminum windows; see Section 07 2500.

## **3.02 PRIME WINDOW INSTALLATION**

- A. Install windows in accordance with manufacturer's instructions.
- B. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.
- C. Install sill and sill end angles.
- D. Install operating hardware not pre-installed by manufacturer.
- E. Install glass and infill panels in accordance with requirements; see Section 08 8000.

## **3.03 ADJUSTING**

- A. Adjust hardware for smooth operation and secure weathertight closure.

## **3.04 CLEANING**

- A. Remove protective material from factory finished aluminum surfaces.
- B. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.

**END OF SECTION**

## SECTION 087100 - DOOR HARDWARE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
  - 1. Swinging doors.
  - 2. Sliding doors.
  - 3. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
  - 1. Mechanical door hardware.
  - 2. Electromechanical door hardware.
  - 3. Cylinders specified for doors in other sections.
- C. Related Sections:
  - 1. Division 08 Section "Hollow Metal Doors and Frames".
  - 2. Division 08 Section "Interior Aluminum Doors and Frames".
  - 3. Division 08 Section "Flush Wood Doors".
  - 4. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
  - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
  - 2. ICC/IBC - International Building Code.
  - 3. NFPA 70 - National Electrical Code.
  - 4. NFPA 80 - Fire Doors and Windows.
  - 5. NFPA 101 - Life Safety Code.
  - 6. NFPA 105 - Installation of Smoke Door Assemblies.
  - 7. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:
  - 1. ANSI/BHMA Certified Product Standards - A156 Series.

2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.
5. ANSI/UL 437- Key Locks.

### 1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
  1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
  2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
  3. Content: Include the following information:
    - a. Type, style, function, size, label, hand, and finish of each door hardware item.
    - b. Manufacturer of each item.
    - c. Fastenings and other pertinent information.
    - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    - e. Explanation of abbreviations, symbols, and codes contained in schedule.
    - f. Mounting locations for door hardware.
    - g. Door and frame sizes and materials.
    - h. Warranty information for each product.
  4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Shop Drawings: Details of electrified access control hardware indicating the following:
  1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

- a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
    - b. Complete (risers, point-to-point) access control system block wiring diagrams.
    - c. Wiring instructions for each electronic component scheduled herein.
  2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- E. Informational Submittals:
1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.
- B. Project Record Documents: Provide record documentation of as-built door hardware sets in digital format (.pdf, .docx, .xlsx, .csv) and as required in Division 01, Project Record Documents.

#### 1.5 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).
- C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the

manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

- E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
  - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
  - 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- F. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.
- G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
  - 1. Function of building, purpose of each area and degree of security required.
  - 2. Plans for existing and future key system expansion.
  - 3. Requirements for key control storage and software.
  - 4. Installation of permanent keys, cylinder cores and software.
  - 5. Address and requirements for delivery of keys.
- H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
  - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
  - 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
  - 3. Review sequence of operation narratives for each unique access controlled opening.
  - 4. Review and finalize construction schedule and verify availability of materials.
  - 5. Review the required inspecting, testing, commissioning, and demonstration procedures
- I. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.7 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.8 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
  - 1. Structural failures including excessive deflection, cracking, or breakage.
  - 2. Faulty operation of the hardware.
  - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  - 4. Electrical component defects and failures within the systems operation.
- C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 BUTT HINGES

- A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:
  - a. Two Hinges: For doors with heights up to 60 inches.
  - b. Three Hinges: For doors with heights 61 to 90 inches.
  - c. Four Hinges: For doors with heights 91 to 120 inches.
  - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
  - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
  - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
  - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
  - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
4. Hinge Options: Comply with the following:
  - a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
5. Manufacturers:
  - a. Hager Companies (HA) - BB Series, 5-knuckle.
  - b. Ives (IV) - 5BB Series, 5-knuckle.
  - c. McKinney (MK) - TA/T4A Series, 5-knuckle.

### 2.2 CONTINUOUS HINGES

- A. Pin and Barrel Continuous Hinges: ANSI/BHMA A156.26 Grade 1-600 pin and barrel continuous hinges with minimum 14 gauge Type 304 stainless steel hinge leaves, concealed stainless pin, and twin self-lubricated nylon bearings at each knuckle separation. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:

- a. Hager Companies (HA).
- b. Markar Products; ASSA ABLOY Architectural Door Accessories (MR).
- c. Pemko (PE).
- d. dormakaba BEST (ST).

## 2.3 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.
  - 1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
  - 2. Furnish dust proof strikes for bottom bolts.
  - 3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
  - 4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
  - 5. Manufacturers:
    - a. Ives (IV).
    - b. Rockwood (RO).
    - c. Trimco (TC).
- B. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
  - 1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
  - 2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
  - 3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
  - 4. Pulls, where applicable, shall be provided with a 10" clearance from the finished floor on the push side to accommodate wheelchair accessibility.
  - 5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets. When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
  - 6. Manufacturers:
    - a. Ives (IV).
    - b. Rockwood (RO).
    - c. Trimco (TC).

## 2.4 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.



1. Manufacturers:
  - a. Corbin Russwin Hardware (RU).
- B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
  1. Threaded mortise cylinders with rings and cams to suit hardware application.
  2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
  3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
  4. Tubular deadlocks and other auxiliary locks.
  5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
  6. Keyway: Manufacturer's Standard.
- C. Keying System: Each type of lock and cylinders to be factory keyed.
  1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
  2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
  3. New System: Key locks to a new key system as directed by the Owner.
- D. Key Quantity: Provide the following minimum number of keys:
  1. Change Keys per Cylinder: Two (2)
  2. Master Keys (per Master Key Level/Group): Five (5).
  3. Construction Keys (where required): Ten (10).
- E. Construction Keying: Provide construction master keyed cylinders.
- F. Key Registration List (Bitting List):
  1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
  2. Provide transcript list in writing or electronic file as directed by the Owner.
  3. Furnish a list of opening numbers with locking devices, showing cylinder types and quantities required when cylinders or cores are to be owner furnished.

## 2.5 KEY CONTROL

- A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.
  1. Manufacturers:
    - a. Lund Equipment (LU).

- b. MMF Industries (MM).
- c. Telkee (TK).

## 2.6 MORTISE LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide locksets with functions and features as follows:
  - a. Heavy duty 12-gauge wrought steel case.
  - b. Stainless steel 3/4" one-piece anti-friction reversible latchbolt with a one-piece hardened stainless steel 1" projection deadbolt.
  - c. Where required by code, provide knurling or abrasive coating on all levers leading to hazardous areas.
  - d. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
  - e. Meets UL Certification Directory ZHLL.R21744 for products used in windstorm rated assemblies.
  - f. Extended cycle test: Locks to have been cycle tested in ordinance with ANSI/BHMA 156.13 requirements to 14.5 million cycles or greater.
  - g. Status indicators inside, outside, or on both sides of doors as specified; available with wording for "locked/unlocked", "vacant/occupied" or custom wording options. Indicator to be located above the cylinder with the inside thumb-turn not blocking the visibility of the indicator status.
  - h. Ten-year limited warranty for mechanical functions.
2. Manufacturers:
  - a. Corbin Russwin Hardware (RU) - ML2000 Series.
  - b. dormakaba BEST (BE) - 45H Series.
  - c. Schlage (SC) - L9000 Series.

## 2.7 DEADLOCKS AND LATCHES

- A. Mortise Deadlocks, Large Case: ANSI/BHMA A156.13 Grade 1 Certified Products Directory (CPD) listed large case mortise type deadlocks constructed of heavy gauge wrought corrosion resistant steel. One piece stainless steel bolts with a 1" throw. Deadlocks to be products of the same source manufacturer and keyway as other locksets.

1. Manufacturers:
  - a. Corbin Russwin Hardware (RU) - ML2000 Series.
  - b. dormakaba BEST (BE) - 47H Series.
  - c. Schlage (SC) - L9460 Series.

## 2.8 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
  - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
  - 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
  - 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
  - 4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
- B. Standards: Comply with the following:
  - 1. Strikes for Mortise Locks and Latches: BHMA A156.13.
  - 2. Strikes for Bored Locks and Latches: BHMA A156.2.
  - 3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
  - 4. Dustproof Strikes: BHMA A156.16.

## 2.9 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
  - 1. Exit devices shall have a five-year warranty.
  - 2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
  - 3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
  - 4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
  - 5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
  - 6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
    - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
    - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide exit devices with functions and features as follows:
  - a. Where required by code, provide knurling or abrasive coating on all levers leading to hazardous areas.
  - b. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
  - c. Meets UL Certification Directory ZHLL.R21744 for products used in windstorm rated assemblies.
  - d. Five-year limited warranty for mechanical features.
2. Manufacturers:
  - a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
  - b. dormakaba BEST (PR) - Apex 2000 Series.
  - c. Von Duprin (VD) - 35A/98 XP Series.

C. Security Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed rim panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be constructed of high grade, heat treated, corrosion resistant nickel steel alloy, and have a full 3/4" throw projection with slide action positive deadlocking.

1. Static Load Force Resistance: Minimum 3000 lbs. certified independent tested.
2. Manufacturers:
  - a. ASSA ABLOY ACCENTRA, formerly known as Yale (YA) - 7050 Series.
  - b. Corbin Russwin Hardware (RU) - ED4000S / ED5000S Series.

## 2.10 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.

2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
  3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
  4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
  5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
  6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.
1. Heavy duty surface mounted door closers shall have a 30-year warranty.
  2. Manufacturers:
    - a. dormakaba (DO) - 8900 Series.
    - b. LCN Closers (LC) - 4040 Series.
    - c. Norton Rixson (NO) - 7500 Series.
- C. Door Closers, Surface Mounted (Unitrol): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted closers with door stop mechanism to absorb dead stop shock on arm and top hinge. Hold-open arms to have a spring loaded mechanism in addition to shock absorber assembly. Arms to be provided with rigid steel main arm and secondary arm lengths proportional to the door width.
1. Manufacturers:
    - a. ASSA ABLOY ACCENTRA, formerly known as Yale (YA) - Unitrol Series.
    - b. Corbin Russwin Hardware (RU) - Unitrol Series.
    - c. Norton Rixson (NO) - Unitrol Series.
- 2.11 ARCHITECTURAL TRIM
- A. Door Protective Trim
1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
  2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and

not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:
  - a. Stainless Steel: 300 grade, .050-inch thick.
5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Manufacturers:
  - a. Ives (IV).
  - b. Rockwood (RO).
  - c. Trimco (TC).

## 2.12 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
  1. Manufacturers:
    - a. Ives (IV).
    - b. Rockwood (RO).
    - c. Trimco (TC).
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
  1. Manufacturers:
    - a. Norton Rixson (RF).
    - b. Rockwood (RO).
    - c. Sargent Manufacturing (SA).

## 2.13 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
  - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
  - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Hurricane and Storm Shelter Compliance: Devices to be U.L. listed for windstorm assemblies where applicable. Provide the appropriate hurricane or storm shelter products that have been independently third party tested, certified, and labeled to meet state and local windstorm building codes applicable to project.
- G. Manufacturers:
  - 1. National Guard Products (NG).
  - 2. Pemko (PE).
  - 3. Zero (ZE).

## 2.14 ELECTRONIC ACCESSORIES

## 2.15 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

## 2.16 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

### 3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

### 3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
  - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
  - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
  - 2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
  - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."



4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Push Plates and Door Pulls: When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
- E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

### 3.4 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
  1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

### 3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

### 3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.

- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

### 3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

### 3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

- B. Manufacturer's Abbreviations:

1. OT - Other
2. MK - McKinney
3. MR - Markar
4. RO - Rockwood
5. RU - Corbin Russwin
6. RF - Rixson
7. NO - Norton
8. PE - Pemko

BRUNSWICK CC - ALAN HOLDEN PUBLIC SAFETY CENTER  
BOLIVIA, NC

Hardware Sets

**Set: 1.0**

Doors: 302B, H2A, H4A

1 Continuous Hinge	FM100	628	MR
1 Rim Exit Device, Nightlatch	ED5200S L957ET	630	RU
1 Cylinder	Type as required		OT
1 Perm Core	Provided by Owner		OT
1 Drop Plate	As Required	689	NO
1 Surface Closer	UNI7500	689	NO
1 Gasketing	Provided By Door/Frame Supplier		OT
1 Rain Guard	346C x Width of Frame Head		PE
1 Sweep	345AV x Length Required		PE
1 Threshold	2001AT		PE

**Set: 2.0**

Doors: 300A, 400B, V1A, V1B, V2A, V2B

1 Continuous Hinge	FM100	628	MR
1 Rim Exit Device, Nightlatch	ED5200S K157ET	630	RU
1 Cylinder	Type as required		OT
1 Perm Core	Provided by Owner		OT
1 Pull	RM201	US32D	RO
1 Drop Plate	As Required	689	NO
1 Surface Closer	UNI7500	689	NO
1 Gasketing	Provided By Door/Frame Supplier		OT
1 Rain Guard	346C x Width of Frame Head		PE
1 Sweep	345AV x Length Required		PE
1 Threshold	2006AT		PE

**Set: 3.0**

1 Set Not Used	Set not used		OT
3 Hinge	T4A3386	US32D	MK
1 Rim Exit Device, Nightlatch	ED5200S L957ET	630	RU
1 Cylinder	Type as required		OT
1 Perm Core	Provided by Owner		OT
1 Surface Closer	UNI7500	689	NO

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1 Gasketing	303AS (Head & Jambs)	PE
1 Rain Guard	346C x Width of Frame Head	PE
1 Sweep	345AV x Length Required	PE
1 Threshold	2001AT	PE

**Set: 4.0**

Doors: 406A

1 Continuous Hinge	FM100	628	MR
1 Storeroom Lock	ML2057 LSA	630C	RU
1 Cylinder	Type as required		OT
1 Perm Core	Provided by Owner		OT
1 Surface Closer	UNI7500	689	NO
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Gasketing	Provided By Door/Frame Supplier		OT
1 Rain Guard	346C x Width of Frame Head		PE
1 Sweep	345AV x Length Required		PE
1 Threshold	271A MSES25SS		PE

**Set: 5.0**

Doors: 501A

1 Continuous Hinge	FM100	628	MR
1 Storeroom Lock	ML2057 LSA	630C	RU
1 Cylinder	Type as required		OT
1 Perm Core	Provided by Owner		OT
1 Surface Closer	UNI7500	689	NO
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Gasketing	Provided By Door/Frame Supplier		OT
1 Rain Guard	346C x Width of Frame Head		PE
1 Sweep	345AV x Length Required		PE
1 Threshold	255x226AT		PE

**Set: 6.0**

Doors: 401C

3 Hinge	TA2314	US32D	MK
1 Classroom Lock	ML2055 LSA	630C	RU
1 Cylinder	Type as required		OT
1 Perm Core	Provided by Owner		OT

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1 Conc Overhead Stop	6 Series	689	RF
1 Surface Closer	7500	689	NO
1 Gasketing	303AS (Head & Jambs)		PE
1 Rain Guard	346C x Width of Frame Head		PE
1 Sweep	345AV x Length Required		PE
1 Threshold	2006AT		PE

**Set: 7.0**

Doors: 100A, 100B, 100C, 100D

1 Continuous Hinge	FM100	628	MR
1 Rim Exit Device, Nightlatch	ED5200 K157ET	630	RU
1 Cylinder	Type as required		OT
1 Perm Core	Provided by Owner		OT
1 Pull	RM201	US32D	RO
1 Drop Plate	As Required	689	NO
1 Surface Closer	CPS7500	689	NO
1 Gasketing	Provided By Door/Frame Supplier		OT

**Set: 8.0**

Doors: 114A, 302A

1 Continuous Hinge	FM100	628	MR
1 Pull	RM201	US32D	RO
1 Push Bar	BP47	US32D	RO
1 Drop Plate	As Required	689	NO
1 Surface Closer	CPS7500	689	NO
1 Gasketing	Provided By Door/Frame Supplier		OT

Notes: Provide silencers at 114A ILO Supplier provided gasketing.

**Set: 9.0**

Doors: 400A

6 Hinge	T4A3386	US32D	MK
1 Mullion	CR9_BKM		RU
2 Fire Rated Rim Exit, Classroom	ED5200A L955ET	630C	RU
3 Cylinder	Type as required		OT
3 Perm Core	Provided by Owner		OT
2 Surface Closer	7500	689	NO

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BOLIVIA, NC

2 Kick Plate	K1050 10" high CSK BEV	US32D	RO
2 Wall Stop	403 (or) 441CU (As Required)	US26D	RO
1 Astragal	S771C x Door Height		PE

**Set: 10.0**

Doors: 306A, 307A, 308A

3 Hinge	TA2714	US26D	MK
1 Dormitory Lock	ML2065 LSA M34	630C	RU
1 Cylinder	Type as required		OT
2 Perm Core	Provided by Owner		OT
1 Surface Closer	7500	689	NO
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO
1 Acoustic Seal Set	PEMKOSTCSET-3A	BL	PE

**Set: 11.0**

Doors: 306AA, 307AA, 308AA

3 Hinge	TA2714	US26D	MK
1 Storeroom Lock	ML2057 LSA	630C	RU
1 Cylinder	Type as required		OT
1 Perm Core	Provided by Owner		OT
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO
3 Silencer	608-RKW		RO

**Set: 12.0**

Doors: 309A

3 Hinge	TA2714	US26D	MK
1 Storeroom Lock	ML2057 LSA	630C	RU
1 Cylinder	Type as required		OT
1 Perm Core	Provided by Owner		OT
1 Mop Plate	K1050 4" high CSK BEV	US32D	RO
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO
1 Gasketing	S88BL (Head & Jambs)		PE

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**Set: 13.0**

Doors: 200AA, 203AA, 204AA, 207AA, 301A

3 Hinge	TA2714	US26D	MK
1 Storeroom Lock	ML2057 LSA	630C	RU
1 Cylinder	Type as required		OT
1 Perm Core	Provided by Owner		OT
1 Conc Overhead Stop	6 Series	689	RF
3 Silencer	608-RKW		RO

**Set: 14.0**

Doors: 201A, 202A, 205A, 206A

3 Hinge	TA2714	US26D	MK
1 Storeroom Lock	ML2057 LSA	630C	RU
1 Cylinder	Type as required		OT
1 Perm Core	Provided by Owner		OT
1 Surface Closer	7500	689	NO
1 Gasketing	S88BL (Head & Jambs)		PE

**Set: 15.0**

Doors: 310A

3 Hinge	TA2714	US26D	MK
1 Storeroom Lock	ML2057 LSA	630C	RU
1 Cylinder	Type as required		OT
1 Perm Core	Provided by Owner		OT
1 Surface Closer	CLP7500	689	NO
3 Silencer	608-RKW		RO

**Set: 16.0**

Doors: 404AA

3 Hinge	TA2714	US26D	MK
1 Storeroom Lock	ML2049 LSA M34	630C	RU
1 Cylinder	Type as required		OT
1 Perm Core	Provided by Owner		OT
1 Surface Closer	CLP7500	689	NO
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
3 Silencer	608-RKW		RO

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**Set: 17.0**

Doors: 402A, 403A, 404A

3 Hinge	TA2714	US26D	MK
1 Classroom Lock	ML2055 LSA	630C	RU
1 Cylinder	Type as required		OT
1 Perm Core	Provided by Owner		OT
1 Conc Overhead Stop	6 Series	689	RF
1 Surface Closer	7500	689	NO
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
3 Silencer	608-RKW		RO

**Set: 18.0**

Doors: 500A

6 Hinge	TA2714	US26D	MK
1 Dust Proof Strike	570	US26D	RO
2 Flush Bolt	555 / 557 (As Required)	US26D	RO
1 Storeroom Lock	ML2057 LSA	630C	RU
1 Cylinder	Type as required		OT
1 Perm Core	Provided by Owner		OT
1 Conc Overhead Stop	6 Series	689	RF
1 Surface Closer	CLP7500	689	NO
2 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Astragal	S771C x Door Height		PE
1 Acoustic Seal Set	PEMKOSTCSET-3A	BL	PE

Notes: Sound seal provided to aid in preventing sound transmission. Opening is not STC rated.

**Set: 19.0**

Doors: 305A

6 Hinge	TA2714	US26D	MK
1 Dust Proof Strike	570	US26D	RO
2 Flush Bolt	555 / 557 (As Required)	US26D	RO
1 Storeroom Lock	ML2057 LSA	630C	RU
1 Cylinder	Type as required		OT
1 Perm Core	Provided by Owner		OT
2 Conc Overhead Stop	6 Series	689	RF



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BOLIVIA, NC

1 Surface Closer	7500	689	NO
1 Astragal	375CR		PE
1 Acoustic Seal Set	PEMKOSTCSET-3A	BL	PE

Notes: Sound seal provided to aid in preventing sound transmission. Opening is not STC rated.

**Set: 20.0**

Doors: 102A, 104A, 105A, 106A, 107A, 109A, 110A, 111A, 112A, 113A

3 Hinge	TA2714	US26D	MK
1 Entrance Lock	ML2054 LSA M34	630C	RU
1 Cylinder	Type as required		OT
1 Perm Core	Provided by Owner		OT
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO
3 Silencer	608-RKW		RO

**Set: 21.0**

Doors: 101A, 103A

6 Hinge	TA2714	US26D	MK
1 Dust Proof Strike	570	US26D	RO
2 Flush Bolt	555 / 557 (As Required)	US26D	RO
1 Classroom Lock	ML2055 LSA	630C	RU
1 Cylinder	Type as required		OT
1 Perm Core	Provided by Owner		OT
1 Conc Overhead Stop	6 Series	689	RF
1 Surface Closer	CLP7500	689	NO
1 Astragal	S771C x Door Height		PE
2 Silencer	608-RKW		RO

**Set: 22.0**

Doors: 200A, 203A, 203BA, 204A, 207A, 208A

3 Hinge	TA2714	US26D	MK
1 Dormitory Lock	ML2065 LSA M34	630C	RU
1 Cylinder	Type as required		OT
1 Perm Core	Provided by Owner		OT
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO
3 Silencer	608-RKW		RO

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**Set: 23.0**

Doors: 401A, 401B

3 Hinge	TA2714	US26D	MK
1 Dormitory Lock	ML2065 LSA M34	630C	RU
1 Cylinder	Type as required		OT
1 Perm Core	Provided by Owner		OT
1 Surface Closer	7500	689	NO
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
3 Silencer	608-RKW		RO

**Set: 24.0**

Doors: 203CA, 203DA

3 Hinge	TA2714	US26D	MK
1 Classroom Lock	ML2055 LSA	630C	RU
1 Perm Core	Provided by Owner		OT
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO
3 Silencer	608-RKW		RO

**Set: 25.0**

Doors: 115A, 313A

3 Hinge	TA2714	US26D	MK
1 Privacy Lock	ML2030 LSA M34 V21	630C	RU
1 Surface Closer	7500	689	NO
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO
1 Gasketing	S88BL (Head & Jambs)		PE

**Set: 26.0**

Doors: 303A, 304A, 311A, 312A

3 Hinge	T4A3786	US26D	MK
1 Push Plate	70C-RKW	US32D	RO
1 Pull Plate	111x70C	US32D	RO
1 Surface Closer	7500	689	NO
1 Kick Plate	K1050 10" high CSK BEV	US32D	RO
1 Wall Stop	403 (or) 441CU (As Required)	US26D	RO
1 Gasketing	S88BL (Head & Jambs)		PE

BRUNSWICK CC - ALAN HOLDEN PUBLIC SAFETY CENTER  
BOLIVIA, NC

**Set: 27.0**

Doors: 208AA, 400C, 400D, 400E, 400F

1 All Hardware

By Door Manufacturer

OT

END OF SECTION 087100

**SECTION 08 8000  
GLAZING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Insulating glass units.
- B. Glazing units.
- C. Plastic films.
- D. Glass coatings.
- E. Glazing compounds.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 2500 - Weather Barriers.
- B. Section 08 4313 - Aluminum-Framed Storefronts: Glazing provided as part of storefront assembly.
- C. Section 08 8813 - Fire-Rated Glazing.

**1.03 REFERENCE STANDARDS**

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).
- C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).
- D. ASTM C1036 - Standard Specification for Flat Glass; 2021.
- E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- F. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).
- G. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2021a.
- H. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.
- I. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2019.
- J. GANA (SM) - GANA Sealant Manual; 2008.
- K. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2023.
- L. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2023.
- M. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2023.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by each of the affected installers.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data on Insulating Glass Unit, Glazing Unit, and Plastic Film Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify

available colors.

- D. Samples: Submit one samples 12 by 21 inch in size of glass units.
- E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

#### **1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

#### **1.07 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Insulating Glass Units: Provide a ten (10) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Float Glass Manufacturers:
  - 1. Guardian Glass, LLC: [www.guardianglass.com/#sle](http://www.guardianglass.com/#sle).
  - 2. Pilkington North America Inc: [www.pilkington.com/na/#sle](http://www.pilkington.com/na/#sle).
  - 3. Vitro Architectural Glass (formerly PPG Glass): [www.vitroglazings.com/#sle](http://www.vitroglazings.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Plastic Films Manufacturers:
  - 1. 3M Window Film: [solutions.3m.com/wps/portal/3M/en\\_US/Window\\_Film/Solutions/#sle](http://solutions.3m.com/wps/portal/3M/en_US/Window_Film/Solutions/#sle).
  - 2. Flexvue Films: [www.flexvuefilms.com/#sle](http://www.flexvuefilms.com/#sle).
  - 3. LLumar, an Eastman Chemical Company: [www.llumar.com/#sle](http://www.llumar.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.

#### **2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES**

- A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
  - 1. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
  - 2. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
  - 3. Glass thicknesses listed are minimum.
- B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.
  - 1. In conjunction with weather barrier related materials described in other sections, as follows:
    - a. Water-Resistive Barriers: See Section 07 2500.
- C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
  - 1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
  - 2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
  - 3. Solar Optical Properties: Comply with NFRC 300 test method.

#### **2.03 GLASS MATERIALS**

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.

1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
2. Kind HS - Heat-Strengthened Type: Complies with ASTM C1048.
3. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
4. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
5. Tinted Type: ASTM C1036, Class 2 - Tinted, Quality - Q3, with color and performance characteristics as indicated.
6. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

## **2.04 BASIS OF DESIGN - INSULATING GLASS UNITS**

- A. Type G-1 - Insulated Exterior Vision Glazing:
- B. Basis of Design - Insulating Glass Units: Vision glazing, with low-e coating.
  1. Applications: Exterior insulating glass glazing unless otherwise indicated.
  2. Space between lites filled with air.
  3. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
    - a. Tint: Vitro Optigray.
    - b. Coating: Vitro Solarban 70 Low-E Coating on #2 surface. \
  4. Inboard Lite: Fully tempered float glass, 1/4" inch thick, minimum.
    - a. Clear Glass.
  5. Total Thickness: 1 inch.
  6. Thermal Transmittance (U-Value), Winter - Center of Glass: 0.28, nominal.
  7. Visible Light Transmittance (VLT): 46 percent, minimum.
  8. Shading Coefficient: 0.28, nominal.
  9. Solar Heat Gain Coefficient (SHGC): 0.25, minimum.
  10. Glazing Method: Dry glazing method, gasket glazing.
  11. Durability: Certified by an independent testing agency to comply with ASTM E2190.
  12. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
  13. Metal Edge Spacers: Aluminum, bent and soldered corners.
  14. Spacer Color: Black.
  15. Edge Seal:
    - a. Single-Sealed System: Provide silicone, polysulfide, or polyurethane sealant as seal applied around perimeter.
  16. Color: Black.
  17. Purge interpane space with dry air, hermetically sealed.

## **2.05 GLAZING UNITS**

- A. Type G-2 - Monolithic Interior Vision Glazing:
  1. Applications: Interior glazing unless otherwise indicated.
  2. Glass Type: Fully tempered float glass.
  3. Tint: Clear.
  4. Thickness: 1/4 inch, nominal.

## **2.06 PLASTIC FILMS**

- A. Type F-1 - Vision Control Plastic Film: Mylar type.
  1. Application: Locations as indicated on drawings for one-way vision.
  2. Color: One-Way Mirror Window Film.
  3. Thickness Without Liner: 0.00236 inch.
  4. Manufacturers:
    - a. 3M Window Films:  
solutions.3m.com/wps/portal/3M/en\_US/Window\_Film/Solutions/#sle.
    - b. Substitutions: See Section 01 6000 - Product Requirements.

## **2.07 ACCESSORIES**

- A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.
- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Continuous by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.
- C. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

## **PART 3 EXECUTION**

### **3.01 VERIFICATION OF CONDITIONS**

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that the minimum required face and edge clearances are being provided.
- C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.
- D. Verify that sealing between joints of glass framing members has been completed effectively.
- E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

### **3.02 PREPARATION**

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

### **3.03 INSTALLATION, GENERAL**

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
- B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
- C. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
- D. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
- E. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, and paint.

### **3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)**

- A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.
- B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
- D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

### **3.05 FIELD QUALITY CONTROL**

- A. See Section 01 4000 - Quality Requirements for additional requirements.

- B. Monitor and report installation procedures and unacceptable conditions.

### **3.06 CLEANING**

- A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove nonpermanent labels immediately after glazing installation is complete.
- C. Clean glass and adjacent surfaces after sealants are fully cured.
- D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

### **3.07 PROTECTION**

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
- B. Remove and replace glass that is damaged during construction period prior to Date of Final Completion.

**END OF SECTION**



**SECTION 08 8813  
FIRE-RATED GLAZING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Fire-rated glazing units.

**1.02 RELATED REQUIREMENTS**

- A. Section 08 1113 - Hollow Metal Doors and Frames: Glazed lites in doors.

**1.03 REFERENCE STANDARDS**

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).
- C. GANA (SM) - GANA Sealant Manual; 2008.
- D. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. ITS (DIR) - Directory of Listed Products; Current Edition.
- F. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.
- G. NFPA 257 - Standard on Fire Test for Window and Glass Block Assemblies; 2022.
- H. UL (DIR) - Online Certifications Directory; Current Edition.
- I. UL 9 - Standard for Fire Tests of Window Assemblies; Current Edition, Including All Revisions.
- J. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.
- K. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data on Glazing Unit Glazing Types: Provide structural, physical, and environmental characteristics, size limitations, special handling and installation requirements.
- C. Samples: one samples 6 by 6 inch in size of glass units.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

**1.06 FIELD CONDITIONS**

- A. Ambient Conditions: Do not install glazing when ambient temperature is less than 40 degrees F.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Fire-Resistance-Rated Glass:
  - 1. Manufacturers:
    - a. SAFTIFIRST, a division of O'Keeffe's Inc; SuperLite II-XL: [www.safti.com/#sle](http://www.safti.com/#sle).
    - b. Vetrotech North America; Contraflam 60: [www.vetrotechusa.com/#sle](http://www.vetrotechusa.com/#sle).
    - c. TGP; Firelite Plus: [www.fireglass.com](http://www.fireglass.com).
    - d. Substitutions: See Section 01 6000 - Product Requirements.

**2.02 GLASS MATERIALS**

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.

## **2.03 GLAZING UNITS**

- A. Type FPG-1 - Fire-Protection-Rated Glazing: Type, thickness, and configuration of glazing that contains flame, smoke, and does not block radiant heat, as required to achieve indicated fire rating period of 60 minutes or less.
  - 1. Applications:
    - a. Glazing in fire-resistance-rated door assembly.
  - 2. Provide products listed by ITS (DIR) or UL (DIR) and approved by authorities having jurisdiction.
  - 3. Safety Glazing Certification: 16 CFR 1201 Category II.
  - 4. Fire-Rating Period: As indicated on drawings.
  - 5. Markings for Fire-Protection-Rated Glazing Assemblies: Provide permanent markings on fire-protection-rated glazing in compliance with ICC (IBC), local building code, and authorities having jurisdiction
    - a. "D" - meets fire door assembly criteria of NFPA 252, UL 10B, or UL 10C fire test standards.
    - b. "OH" - meets fire window assembly criteria, including hose stream test of NFPA 257 or UL 9 fire test standards.
    - c. "H" - meets fire door assembly hose stream test of NFPA 252, UL 10B, or UL 10C fire tests standards.
    - d. "XXX" - placeholder that represents fire-rating period, in minutes.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION - GENERAL**

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers unless more stringent requirements are indicated, including those in referenced glazing standards.
- B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
- C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
- D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
- E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
- F. Prevent glass from contact with contaminating substances that may result from construction operations including, but not limited to weld spatter, fire-safing, plastering, mortar droppings, etc.

### **3.02 PROTECTION**

- A. After installation, mark pane with 'X' by using removable plastic tape or paste; do not mark heat-absorbing or reflective glass units.
- B. Remove and replace glass that is damaged during construction period prior to Date of Final Completion.

**END OF SECTION**

**SECTION 08 9100  
LOUVERS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Louvers, frames, and accessories.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 2500 - Weather Barriers: Sealing frames to water-resistive barrier installed on adjacent construction.
- B. Section 07 6200 - Sheet Metal Flashing and Trim.
- C. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.

**1.03 REFERENCE STANDARDS**

- A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.
- C. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, and tolerances; head, jamb and sill details; blade configuration, screens, blank-off areas required, and frames.
- D. Samples: Submit finish color selection samples of actual metal 2 by 2 inches in size illustrating finish and color of exterior surfaces.
- E. Test Reports: Independent agency reports showing compliance with specified performance criteria.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.

**1.06 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Provide five year manufacturer's warranty against distortion, metal degradation, connection failures, and water tightness of louver components.
  - 1. Finish: Include twenty year coverage against degradation of exterior finish.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Basis of Design Product: Ruskin; EME3625MD: [www.ruskin.com/#sle](http://www.ruskin.com/#sle).
- B. Other Acceptable Manufactures:
  - 1. Airolite Company, LLC: [www.airolite.com/#sle](http://www.airolite.com/#sle).
  - 2. Pottorff: [www.pottorff.com/#sle](http://www.pottorff.com/#sle).
  - 3. Substitutions: See Section 01 6000 - Product Requirements.

**2.02 LOUVERS**

- A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories. AMCA Certified in accordance with AMCA 540 and 550.
  - 1. Wind Load Resistance: Design to resist positive and negative wind load indicated on drawings without damage or permanent deformation.
  - 2. Drainable Blades: Vertical orientation with Class A wind-driven rain performance.

3. Screens: Provide bird screens at louvers.
- B. Stationary Louvers: Vertical blade, extruded aluminum construction.
  1. Free Area: 55%, minimum.
  2. Blades: Drainable.
  3. Frame: 3 inch deep, channel profile; integral frame with extended sill.
  4. Aluminum Finish: High performance organic coatings; finish welded units after fabrication.
  5. Frame Size: As indicated on drawings.

### **2.03 FINISHES**

- A. High Performance Organic Coatings: AAMA 2604; multiple coats, thermally cured fluoropolymer system.

### **2.04 ACCESSORIES**

- A. Screens: Frame of same material as louver, with reinforced corners; removable, screw attached; installed on inside face of louver frame.
- B. Bird Screen: Interwoven wire mesh of galvanized, 14 gauge, 0.0641 inch diameter wire, 1/2 inch open weave, square design.
- C. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that prepared openings and flashings are ready to receive this work and opening dimensions are as indicated on shop drawings.

### **3.02 INSTALLATION**

- A. Install louver assembly in accordance with manufacturer's instructions.
- B. Coordinate with installation of flashings by others.
- C. Install louvers level and plumb.
- D. Align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.
- E. Secure louver frames in openings with concealed fasteners.
- F. Coordinate with installation of mechanical ductwork.

### **3.03 CLEANING**

- A. Strip protective finish coverings.
- B. Clean surfaces and components.

**END OF SECTION**

**SECTION 09 0561**  
**COMMON WORK RESULTS FOR FLOORING PREPARATION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
  - 1. Carpet tile.
  - 2. Thin-set ceramic tile and stone tile.
- B. Preparation of new concrete floor slabs for installation of floor coverings.
- C. Testing of concrete floor slabs for moisture and alkalinity (pH).
- D. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
  - 1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.
- E. Patching compound.
- F. Remedial floor coatings.

**1.02 RELATED REQUIREMENTS**

**1.03 REFERENCE STANDARDS**

- A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50 mm [2 in.] Cube Specimens); 2023.
- B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters, and Gypsum Concrete; 2020.
- C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.
- D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

**1.05 SUBMITTALS**

- A. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
  - 1. Moisture and alkalinity (pH) limits and test methods.
  - 2. Manufacturer's required bond/compatibility test procedure.
- B. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.
  - 1. Manufacturer's qualification statement.
  - 2. Certificate: Manufacturer's certification of compatibility with types of flooring applied over remedial product.
  - 3. Test reports indicating compliance with specified performance requirements, performed by nationally recognized independent testing agency.
  - 4. Manufacturer's installation instructions.
  - 5. Specimen Warranty: Copy of warranty to be issued by coating manufacturer and certificate of underwriter's coverage of warranty.
- C. Testing Agency's Report:
  - 1. Description of areas tested; include floor plans and photographs if helpful.

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2. Summary of conditions encountered.
3. Moisture and alkalinity (pH) test reports.
4. Copies of specified test methods.
5. Recommendations for remediation of unsatisfactory surfaces.
6. Product data for recommended remedial coating.
7. Submit report to Architect.
8. Submit report not more than two business days after conclusion of testing.

D. Adhesive Bond and Compatibility Test Report.

#### **1.06 QUALITY ASSURANCE**

- A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.
- B. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
  1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.
- C. Contractor's Responsibility Relating to Independent Agency Testing:
  1. Provide access for and cooperate with testing agency.
  2. Confirm date of start of testing at least 10 days prior to actual start.
  3. Allow at least 4 business days on site for testing agency activities.
  4. Achieve and maintain specified ambient conditions.
  5. Notify Architect when specified ambient conditions have been achieved and when testing will start.
- D. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, handle, and protect products in accordance with manufacturer's instructions and recommendations.
- B. Deliver materials in manufacturer's packaging; include installation instructions.
- C. Keep materials from freezing.

#### **1.08 FIELD CONDITIONS**

- A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.
- B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

### **PART 2 PRODUCTS**

#### **2.01 MATERIALS**

- A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
  1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
  2. Latex or polyvinyl acetate additions are permitted; gypsum content is prohibited.
  3. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.

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- B. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.
- C. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
  - 1. Thickness: As required for application and in accordance with manufacturer's installation instructions.
  - 2. Use product recommended by testing agency.

### **PART 3 EXECUTION**

#### **3.01 CONCRETE SLAB PREPARATION**

- A. Perform following operations in the order indicated:
  - 1. Preliminary cleaning.
  - 2. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
  - 3. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
  - 4. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
  - 5. Specified remediation, if required.
  - 6. Patching, smoothing, and leveling, as required.
  - 7. Other preparation specified.
  - 8. Adhesive bond and compatibility test.
  - 9. Protection.
- B. Remediations:
  - 1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
  - 2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
  - 3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

#### **3.02 PRELIMINARY CLEANING**

- A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.
- B. Do not use solvents or other chemicals for cleaning.

#### **3.03 MOISTURE VAPOR EMISSION TESTING**

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F1869 and as follows.

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- D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.
- F. Report: Report the information required by the test method.

**3.04 ALKALINITY TESTING**

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.
  - 1. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.
  - 2. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.
- C. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

**3.05 PREPARATION**

- A. See individual floor covering section(s) for additional requirements.
- B. Comply with requirements and recommendations of floor covering manufacturer.
- C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
- D. Do not fill expansion joints, isolation joints, or other moving joints.

**3.06 ADHESIVE BOND AND COMPATIBILITY TESTING**

- A. Comply with requirements and recommendations of floor covering manufacturer.

**3.07 APPLICATION OF REMEDIAL FLOOR COATING**

- A. Comply with requirements and recommendations of coating manufacturer.

**3.08 PROTECTION**

- A. Cover prepared floors with building paper or other durable covering.

**END OF SECTION**



**SECTION 09 2116  
GYPSUM BOARD ASSEMBLIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Performance criteria for gypsum board assemblies.
- B. Metal stud wall framing.
- C. Metal channel ceiling framing.
- D. Resilient sound isolation clips.
- E. Gypsum sheathing.
- F. Cementitious backing board.
- G. Gypsum wallboard.
- H. Joint treatment and accessories.
- I. Acoustic (sound-dampening) wall and ceiling board.

**1.02 RELATED REQUIREMENTS**

- A. Section 05 4000 - Cold-Formed Metal Framing: Structural steel stud framing.
- B. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.
- C. Section 07 2100 - Thermal Insulation: Acoustic insulation.
- D. Section 07 2500 - Weather Barriers: Water-resistive barrier over sheathing.
- E. Section 07 8400 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.
- F. Section 07 9200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.
- G. Section 09 3000 - Tiling: Tile backing board.

**1.03 REFERENCE STANDARDS**

- A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).
- B. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.
- C. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).
- D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
- E. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.
- F. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020.
- G. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).
- H. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
- I. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2023.
- J. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.
- K. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.

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- L. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.
- M. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.
- N. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing; 2018 (Reapproved 2023).
- O. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.
- P. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
- Q. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.
- R. ASTM E413 - Classification for Rating Sound Insulation; 2022.
- S. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).
- T. GA-216 - Application and Finishing of Gypsum Panel Products; 2021.

#### **1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data:
  - 1. Provide data on metal framing, gypsum board, glass mat faced gypsum board, accessories, and joint finishing system.
  - 2. Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- C. Shop Drawings: Indicate special details associated with acoustic seals.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Store gypsum products and accessories indoors and keep above freezing. Elevate boards above floor, on nonwicking supports, in accordance with manufacturer's recommendations.
- B. Store metal products to prevent corrosion.

### **PART 2 PRODUCTS**

#### **2.01 GYPSUM BOARD ASSEMBLIES**

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
- B. Interior Partitions, Indicated as Sound-Rated: Provide completed assemblies with the following characteristics:
  - 1. Acoustic Attenuation: STC as indicated calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

#### **2.02 METAL FRAMING MATERIALS**

- A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.
- B. Nonstructural Framing System Components: AISI S220; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf.
  - 1. Studs: C-shaped.
  - 2. Runners: U shaped, sized to match studs.
  - 3. Ceiling Channels: C-shaped.
  - 4. Resilient Furring Channels: Single or double leg configuration; 1/2 inch channel depth.
- C. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws, and prevent rotation of studs while maintaining structural performance of partition.

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1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100.
2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot-dipped galvanized coating.

## 2.03 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:
  1. American Gypsum Company: [www.americangypsum.com/#sle](http://www.americangypsum.com/#sle).
  2. CertainTeed Corporation: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
  3. Georgia-Pacific Gypsum: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
  4. Gold Bond Building Products, LLC provided by National Gypsum Company: [www.goldbondbuilding.com/#sle](http://www.goldbondbuilding.com/#sle).
  5. USG Corporation: [www.usg.com/#sle](http://www.usg.com/#sle).
  6. Substitutions: See Section 01 6000 - Product Requirements.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
  1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
  2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
    - a. Mold resistant board is required at all locations.
  3. Thickness:
    - a. Vertical Surfaces: 5/8 inch.
    - b. Ceilings: 5/8 inch.
    - c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
  4. Mold-Resistant, Paper-Faced Products:
    - a. American Gypsum Company; M-Bloc: [www.americangypsum.com/#sle](http://www.americangypsum.com/#sle).
    - b. CertainTeed Corporation; M2Tech 5/8" Type X Moisture & Mold Resistant Drywall: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
    - c. Georgia-Pacific Gypsum; ToughRock Mold-Guard: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
    - d. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond XP Gypsum Board: [www.goldbondbuilding.com/#sle](http://www.goldbondbuilding.com/#sle).
    - e. USG Corporation; Sheetrock Brand EcoSmart Panels Mold Tough Firecode X 5/8 in. (15.9 mm): [www.usg.com/#sle](http://www.usg.com/#sle).
    - f. Substitutions: See Section 01 6000 - Product Requirements.
- C. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
  1. Application: Exterior sheathing, unless otherwise indicated.
  2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
  3. Fungal Resistance: No fungal growth when tested in accordance with ASTM G21.
  4. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
  5. Core Type: Regular.
  6. Regular Board Thickness: 5/8 inch.
  7. Edges: Square.
  8. Glass Mat Faced Products:
    - a. American Gypsum Company; M-Glass Exterior Sheathing Type X: [www.americangypsum.com/#sle](http://www.americangypsum.com/#sle).
    - b. CertainTeed Corporation; GlasRoc Type X Exterior Sheathing: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
    - c. Georgia-Pacific Gypsum; DensGlass Sheathing: [www.gpgypsum.com/#sle](http://www.gpgypsum.com/#sle).
    - d. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond eXP Fire-Shield Sheathing: [www.goldbondbuilding.com/#sle](http://www.goldbondbuilding.com/#sle).
    - e. USG Corporation; Securock Brand UltraLight Glass-Mat Sheathing Firecode X 5/8 in. (15.9 mm): [www.usg.com/#sle](http://www.usg.com/#sle).
    - f. Substitutions: See Section 01 6000 - Product Requirements.

## **2.04 GYPSUM BOARD ACCESSORIES**

- A. Acoustic Insulation: See Section 07 2100.
- B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
- C. Water-Resistive Barrier: See Section 07 2500.
- D. Beads, Joint Accessories, and Other Trim: ASTM C1047, rigid plastic, unless noted otherwise.
  - 1. Corner Beads: Low profile, for 90 degree outside corners.
  - 2. L-Trim with Tear-Away Strip: Sized to fit 5/8-inch thick gypsum wallboard.
  - 3. Expansion Joints:
    - a. Type: V-shaped PVC with tear away fins.
- E. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
- F. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.
- G. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that project conditions are appropriate for work of this section to commence.

### **3.02 FRAMING INSTALLATION**

- A. Metal Framing: Install in accordance with ASTM C1007/AISI S220 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members at 16 inches on center.
- C. Studs: Space studs at 16 inches on center.
  - 1. Extend partition framing to structure where indicated and to distance above ceiling as indicated.
  - 2. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.
- D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
- E. Acoustic Furring: Install resilient channels at maximum 16 inches on center. Locate joints over framing members.
- F. Blocking: Install wood blocking for support of:
  - 1. Wall-mounted cabinets.
  - 2. Plumbing fixtures.
  - 3. Toilet partitions.
  - 4. Toilet accessories.
  - 5. Wall-mounted door hardware.

### **3.03 ACOUSTIC ACCESSORIES INSTALLATION**

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
  - 1. Place one bead continuously on substrate before installation of perimeter framing members.
  - 2. Place continuous bead at perimeter of each layer of gypsum board.

09 2116 Gypsum Board  
Assemblies

3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

**3.04 BOARD INSTALLATION**

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
- C. Double-Layer, Nonrated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Place second layer parallel to framing or furring members. Offset joints of second layer from joints of first layer.
- D. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.
- E. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
  1. Seal joints, cut edges, and holes with water-resistant sealant.
- F. Installation on Metal Framing: Use screws for attachment of gypsum board.

**3.05 INSTALLATION OF TRIM AND ACCESSORIES**

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
  1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

**3.06 JOINT TREATMENT**

- A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
  1. Level 5: Walls and ceilings to receive paint finish in areas specifically indicated. Provide Level 5 finish in V1, V2, Lobby 100, H1, H2, H3, H4, and Student Lounge 302.
  2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
  3. Level 1: Wall areas above finished ceilings, whether or not accessible in the completed construction.
- B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
  1. Feather coats of joint compound so that camber is maximum 1/32 inch.
- C. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

**3.07 TOLERANCES**

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

**3.08 PROTECTION**

- A. Protect installed gypsum board assemblies from subsequent construction operations.

**END OF SECTION**

**SECTION 09 3000  
TILING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Tile for shower receptors.
- D. Cementitious backer board as tile substrate.
- E. Stone thresholds.
- F. Non-ceramic trim.

**1.02 RELATED REQUIREMENTS**

**1.03 REFERENCE STANDARDS**

- A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2019.
- B. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2023.
- C. ANSI A108.1b - Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set, Modified Dry-Set, or Improved Modified Dry-Set Cement Mortar; 2023.
- D. ANSI A108.1c - Contractor's Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set, Modified Dry-Set, or Improved Modified Dry-Set Cement Mortar; 2023.
- E. ANSI A108.2 - American National Standard General Requirements: Materials, Environmental and Workmanship; 2019.
- F. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesive or Water Cleanable Tile-Setting Epoxy Adhesive; 2023.
- G. ANSI A108.5 - Setting of Ceramic Tile with Dry-Set Cement Mortar, Modified Dry-Set Cement Mortar, EGP (Exterior Glue Plywood) Modified Dry-Set Cement Mortar, or Improved Modified Dry-Set Cement Mortar; 2023.
- H. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grout Epoxy; 2023.
- I. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 1999 (Reaffirmed 2019).
- J. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 2023.
- K. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 2017 (Reaffirmed 2022).
- L. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2018.
- M. ANSI A108.12 - Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Modified Dry-Set Mortar; 2023.
- N. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005 (Reaffirmed 2021).
- O. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar; 2020.

- P. ANSI A108.20 - American National Standard Specifications for Exterior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs; 2020.
- Q. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2023.
- R. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2019.
- S. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 2019.
- T. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2023.
- U. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2014 (Reaffirmed 2019).
- V. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2022.
- W. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products; 2018 (Reapproved 2023).
- X. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2024.
- Y. TCNA (HB-GP) - Handbook for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs Installation; 2023.

#### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by affected installers.

#### **1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Installer's Qualification Statement:
- D. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.

#### **1.06 QUALITY ASSURANCE**

- A. Maintain one copy of ANSI A108/A118/A136, TCNA (HB), and TCNA (HB-GP) on-site.
- B. Installer Qualifications:
  - 1. Company specializing in performing tile installation, with minimum of five years of documented experience.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

#### **1.08 FIELD CONDITIONS**

- A. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.

### **PART 2 PRODUCTS**

#### **2.01 TILE**

- A. Manufacturers: All products by the same manufacturer.
  - 1. American Olean Corporation: [www.americanolean.com/#sle](http://www.americanolean.com/#sle).

2. Dal-Tile Corporation: [www.daltile.com/#sle](http://www.daltile.com/#sle).
  3. Emser Tile, LLC: [www.emser.com/#sle](http://www.emser.com/#sle).
  4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Porcelain Wall Tile, Type PT1: ANSI A137.1 standard grade.
1. Basis of Design: Daltile, "Fabric Art" Colorbody Porcelain with Reveal Imaging
  2. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
  3. Size: (12 x 24) inch, nominal.
  4. Thickness: 5/16 inch.
  5. Edges: Square.
  6. Surface Finish: Unglazed.
  7. Color(s): To be selected by Architect from manufacturer's standard range.
  8. Trim Units: Matching cove base shapes in 6 x 12 inches.
- C. Porcelain Floor Tile, Type PT2: ANSI A137.1 standard grade.
1. Basis of Design: Daltile, "Portfolio" (Core Fundamentals Choice or Keystone) Colorbody Porcelain Mosaic
  2. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.
  3. Size: 2 by 2 inch, nominal.
  4. Thickness: 1/4 inch.
  5. Edges: Square.
  6. Surface Finish: Unglazed.
  7. Color(s): To be selected by Architect from manufacturer's standard range.

## 2.02 TRIM AND ACCESSORIES

- A. Non-Ceramic Trim: Brushed stainless steel, style and dimensions to suit application, set with tile mortar or adhesive.
1. Applications:
    - a. Open edges of wall tile.
    - b. Outside wall corners.
    - c. Floor and wall expansion and control joints.
  2. Products:
    - a. Genesis APS International: [www.genesis-aps.com/#sle](http://www.genesis-aps.com/#sle).
    - b. LATICRETE International, Inc: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
    - c. Schluter-Systems; Rondec: [www.schluter.com/#sle](http://www.schluter.com/#sle).
    - d. Substitutions: See Section 01 6000 - Product Requirements.
- B. Thresholds: 2 inches wide by full width of wall or frame opening; beveled edge on both long edges; without holes, cracks, or open seams.
1. Thickness: 1/2 inch.
  2. Material: Marble, honed finish.
  3. Applications:
    - a. At doorways where tile terminates.
    - b. At open side of shower stalls.

## 2.03 SETTING MATERIALS

- A. Provide setting and grout materials from same manufacturer.
- B. Manufacturers:
1. ARDEX Engineered Cements: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
  2. LATICRETE International, Inc: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
  3. Mapei Corporation: [www.mapei.com/#sle](http://www.mapei.com/#sle).
  4. Substitutions: See Section 01 6000 - Product Requirements.
- C. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.
1. Applications: Use this type of bond coat where indicated, and where no other type of bond coat is indicated.
  2. Products:



- a. ARDEX Engineered Cements; ARDEX N 23 MICROTEC: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
  - b. LATICRETE International, Inc; 254 Platinum: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
  - c. Mapei Corporation; Keraflex Plus: [www.mapei.com/#sle](http://www.mapei.com/#sle).
- D. Mortar Bed Materials: Pre-packaged mix of Portland cement, sand, latex additive, and water.
- 1. Products:
    - a. ARDEX Engineered Cements; A 38: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
    - b. LATICRETE International, Inc; LATICRETE 3701 Fortified Mortar Bed: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
    - c. Mapei Corporation; 4 to 1 Mud Bed Mix: [www.mapei.com/#sle](http://www.mapei.com/#sle).
    - d. Substitutions: See Section 01 6000 - Product Requirements.

#### 2.04 GROUTS

- A. Provide setting and grout materials from same manufacturer.
- B. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
  - 1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
  - 2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
  - 3. Color(s): As selected by Architect from manufacturer's full line.
  - 4. Products:
    - a. ARDEX Engineered Cements; ARDEX FL: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
    - b. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
    - c. Mapei Corporation; Ultracolor Plus FA: [www.mapei.com/#sle](http://www.mapei.com/#sle).
    - d. Substitutions: See Section 01 6000 - Product Requirements.

#### 2.05 MAINTENANCE MATERIALS

- A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
  - 1. Applications: Between tile and plumbing fixtures.
  - 2. Color(s): As selected by Architect from manufacturer's full line.
  - 3. Products:
    - a. ARDEX Engineered Cements; ARDEX SX: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
    - b. LATICRETE International, Inc; LATICRETE LATASIL: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
    - c. Mapei Corporation; Mapesil T Plus: [www.mapei.com/#sle](http://www.mapei.com/#sle).
    - d. Substitutions: See Section 01 6000 - Product Requirements.

#### 2.06 ACCESSORY MATERIALS

- A. Waterproofing Membrane at Floors: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
  - 1. Crack Resistance: No failure at 1/16 inch gap, minimum; comply with ANSI A118.12.
  - 2. Fluid or Trowel Applied Type:
    - a. Material: Synthetic rubber or Acrylic.
    - b. Thickness: 25 mils, minimum, dry film thickness.
    - c. Products:
      - 1) ARDEX Engineered Cements; ARDEX 8+9: [www.ardexamericas.com/#sle](http://www.ardexamericas.com/#sle).
      - 2) LATICRETE International, Inc; LATICRETE HYDRO BAN: [www.laticrete.com/#sle](http://www.laticrete.com/#sle).
      - 3) Mapei Corporation; Mapelastic AquaDefense: [www.mapei.com/#sle](http://www.mapei.com/#sle).
      - 4) Substitutions: See Section 01 6000 - Product Requirements.
- B. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 5/8 inch thick; 2 inch wide coated glass fiber tape for joints and corners.
  - 1. Products:
    - a. Georgia Pacific; DensShield: [www.densshield.com](http://www.densshield.com)

- b. National Gypsum; PermaBase: [www.permabase.com](http://www.permabase.com)
- c. USG; Durock Cement Board: [www.usg.com](http://www.usg.com)
- d. Substitutions: See Section 01 6000 - Product Requirements.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling installation by testing for moisture and alkalinity (pH).
  - 1. Obtain instructions if test results are not within limits recommended by tiling material manufacturer and setting material manufacturer.

#### **3.02 PREPARATION**

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.
- E. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

#### **3.03 INSTALLATION - GENERAL**

- A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.20, manufacturer's instructions, and TCNA (HB) or TCNA (HB-GP) recommendations, as applicable.
- B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- E. Form internal angles square and external angles square.
- F. Install non-ceramic trim in accordance with manufacturer's instructions.
- G. Install thresholds where indicated.
- H. Sound tile after setting. Replace hollow sounding units.
- I. Keep control and expansion joints free of mortar, grout, and adhesive.
- J. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- K. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
- L. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

#### **3.04 INSTALLATION - FLOORS - THIN-SET METHODS**

- A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.

**3.05 INSTALLATION - SHOWERS AND BATHTUB WALLS**

- A. At tiled shower receptors install in accordance with TCNA (HB) Method B415, mortar bed floor, and W244, thin-set over cementitious backer unit walls.
- B. Grout with standard grout as specified above.

**3.06 INSTALLATION - WALL TILE**

- A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms.

**3.07 CLEANING**

- A. Clean tile and grout surfaces.

**3.08 PROTECTION**

- A. Do not permit traffic over finished floor surface for 4 days after installation.

**3.09 SCHEDULE**

**END OF SECTION**

**SECTION 09 5100  
ACOUSTICAL CEILINGS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

**1.02 RELATED REQUIREMENTS**

**1.03 REFERENCE STANDARDS**

- A. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.
- B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.
- C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2022.
- D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on suspension system components and acoustical units.
- C. Samples: Submit two samples 4 by 4 inch in size illustrating material and finish of acoustical units.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Acoustical Units: 100 sq ft of each type and size.

**1.06 QUALITY ASSURANCE**

- A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

**1.07 FIELD CONDITIONS**

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Acoustic Tiles/Panels:
  - 1. Armstrong World Industries, Inc; Ultima: [www.armstrongceilings.com/#sle](http://www.armstrongceilings.com/#sle).
  - 2. Certainteed Architectural; Symphony m: [www.certainteed.com/ceilings-and-walls/#sle](http://www.certainteed.com/ceilings-and-walls/#sle).
  - 3. USG Corporation; Mars Clima Plus: [www.usg.com/ceilings/#sle](http://www.usg.com/ceilings/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Suspension Systems:
  - 1. Same as for acoustical units.

## **2.02 ACOUSTICAL UNITS**

- A. Acoustical Units - General: ASTM E1264, Class A.
- B. Acoustical Tiles: Painted mineral fiber, with the following characteristics:
  - 1. Classification: ASTM E1264 Type IV.
    - a. Form: 2, water felted.
    - b. Pattern: "E" - lightly textured.
  - 2. Size: 24 by 24 inches.
  - 3. Thickness: 3/4 inch.
  - 4. Light Reflectance: 85 min percent, determined in accordance with ASTM E1264.
  - 5. NRC Range: .75 to .80, determined in accordance with ASTM E1264.
  - 6. Ceiling Attenuation Class (CAC): 35 min, determined in accordance with ASTM E1264.
  - 7. Tile Edge: Square.
    - a. Joint: Kerfed and rabbeted.
  - 8. Color: White.
  - 9. Suspension System: Exposed grid.

## **2.03 SUSPENSION SYSTEM(S)**

- A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, stabilizer bars, clips, and splices as required.
- B. Exposed Suspension System, Type 1: Hot-dipped galvanized steel grid with aluminum cap.
  - 1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
  - 2. Profile: Tee; 9/16 inch face width.
  - 3. Finish: Baked enamel.
  - 4. Color: White.

## **2.04 ACCESSORIES**

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.
- B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.
- C. Perimeter Moldings: Same metal and finish as grid.
  - 1. Angle Molding: L-shaped, for mounting at same elevation as face of grid.
- D. Touch-up Paint: Type and color to match acoustical and grid units.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

### **3.02 INSTALLATION - SUSPENSION SYSTEM**

- A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Locate system on room axis according to reflected plan.
- D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
  - 1. Use longest practical lengths.
  - 2. Overlap and rivet corners.
- E. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

- F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- I. Do not eccentrically load system or induce rotation of runners.

### **3.03 INSTALLATION - ACOUSTICAL UNITS**

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- E. Cutting Acoustical Units:
  - 1. Make field cut edges of same profile as factory edges.
  - 2. Double cut and field paint exposed reveal edges.

### **3.04 TOLERANCES**

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

### **3.05 CLEANING**

- A. Clean surfaces.
- B. Replace damaged or abraded components.

**END OF SECTION**

**SECTION 09 5426  
SUSPENDED WOOD CEILINGS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Linear wood planks.
- B. Wood grilles.
- C. Metal suspension system.

**1.02 REFERENCE STANDARDS**

- A. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.
- B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- D. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2022.
- E. Cisca (WC) - Wood Ceilings Technical Guidelines; 2009.

**1.03 ADMINISTRATIVE REQUIREMENTS**

- A. Sequence work to ensure ceilings are not installed until building is enclosed, dust generating activities have terminated, and overhead work is completed.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate grid layout and related dimensioning, attachment of wood ceiling components to grid, accessory attachments, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.
- C. Product Data: Provide data on wood ceiling components and suspension system components.
- D. Samples: Submit two samples each, 6 inches long, of suspension system main runner, cross runner, and perimeter molding.
- E. Test Reports: Certified test data from an independent test agency verifying that panels meet specified requirements for fire and acoustical performance.
- F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements for additional provisions.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with at least three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver wood ceiling components to project site in original, unopened packages.
- B. Store in fully enclosed space, flat, level and off the floor.

**1.07 FIELD CONDITIONS**

- A. Do not install suspended wood ceiling system until wet construction work is complete and permanent heat and air conditioning is installed and operating.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Suspended Wood Ceilings:
  - 1. Armstrong World Industries, Inc; Woodworks: [www.armstrongceilings.com/#sle](http://www.armstrongceilings.com/#sle).
  - 2. Certaineed Architectural; Grill Modules: [www.certainteed.com/ceilings-and-walls/#sle](http://www.certainteed.com/ceilings-and-walls/#sle).
  - 3. Sound Seal; (Woodtrends Wood Grille): [www.soundseal.com/woodtrends](http://www.soundseal.com/woodtrends).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.

### **2.02 SUSPENDED WOOD CEILING SYSTEM**

- A. Performance Requirements:
  - 1. Design for maximum deflection of 1/360 of span.
  - 2. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
- B. Wood Grilles: Pre-assembled module of wood veneer grilles with battens.
  - 1. Module Size: 24 by 96 inches, nominal.
  - 2. Grille Size: 3/4 inch width by 2-1/4 inch depth.
  - 3. Grille Spacing (Reveal): 1-1/4 inch. (6 blades per foot).
  - 4. Acoustical Backer: Fiberglass, 1 inch thick.
    - a. Color: Black.
  - 5. Veneer Species: White Oak.
    - a. Veneer Cut: Rift cut.
    - b. Factory Finish: Clear sealer.
  - 6. Attachment to Suspension Grid: Direct screw attachment to suspension grid.
  - 7. Suspension System: Type specified below.
- C. Metal Suspension System:
  - 1. General: Comply with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, stabilizer bars, clips, and splices as required.
  - 2. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement.
- D. Accessories: Manufacturer's standard accessories for installation method indicated, above-ceiling accessibility.

### **2.03 FABRICATION**

- A. Shop fabricate wood ceiling components to the greatest extent possible.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Do not install ceiling until after interior wet work is dry.

### **3.02 PREPARATION**

- A. Coordinate the location of hangers with other work.
- B. Layout wood ceiling components in pattern according to reflected ceiling plan and as shown on shop drawings.
- C. Acclimate wood ceiling materials by removing from packaging in installation area a minimum of 48 hours prior to installation.

### **3.03 INSTALLATION**

- A. General: Install suspended wood ceiling system in accordance with CISCA (WC).
- B. Suspension System:
  - 1. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.



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Ceilings

2. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
  3. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
  4. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
  5. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
  6. Do not eccentrically load system or induce rotation of runners.
- C. Wood Ceiling:
1. Install wood ceilings in accordance with manufacturer's instructions.
  2. Fit wood components in place, free from damaged edges or other defects detrimental to appearance and function.
  3. Install components in uniform plane, and free from twist, warp, and dents.
  4. Cut to fit irregular grid and perimeter edge trim.
  5. Make field cut edges of same profile as factory edges, seal and finish according to manufacturer.
  6. Install acoustical backer above wood ceiling components; fit tight between grid members.

**3.04 TOLERANCES**

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

**3.05 CLEANING**

- A. Clean and touch up minor finish damage. Remove and replace components that cannot be successfully cleaned and repaired.

**END OF SECTION**

**SECTION 09 6500  
RESILIENT FLOORING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Resilient base.
- B. Installation accessories.

**1.02 RELATED REQUIREMENTS**

**1.03 REFERENCE STANDARDS**

- A. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.

**1.07 FIELD CONDITIONS**

- A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

**PART 2 PRODUCTS**

**2.01 RESILIENT BASE**

- A. Resilient Base: ASTM F1861, Type TP, rubber, thermoplastic.
  - 1. Manufacturers:
    - a. Johnsonite, a Tarkett Company; Mandalay H6: [www.johnsonite.com/#sle](http://www.johnsonite.com/#sle).
    - b. Mannington Commercial; Edge Effects, Simplicity 6 Inch: [www.manningtoncommercial.com/#sle](http://www.manningtoncommercial.com/#sle).
    - c. Roppe Corporation; Vertical #65: [www.roppe.com/#sle](http://www.roppe.com/#sle).
    - d. Substitutions: See Section 01 6000 - Product Requirements.
  - 2. Height: 6 inches.
  - 3. Thickness: 0.125 inch.
  - 4. Finish: Satin.
  - 5. Length: 8 foot sections.
  - 6. Color: To be selected by Architect from manufacturer's full range.

**2.02 ACCESSORIES**

- A. Adhesives: Waterproof; types recommended by wall base manufacturer.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

**3.02 INSTALLATION - GENERAL**

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.

**3.03 INSTALLATION - RESILIENT BASE**

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.
- B. Install base on solid backing. Bond tightly to wall and floor surfaces.

**END OF SECTION**

**SECTION 09 6700  
FLUID-APPLIED FLOORING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Fluid-applied flooring and base.

**1.02 RELATED REQUIREMENTS**

- A. Section 07 9200 - Joint Sealants: Sealing joints between fluid-applied flooring and adjacent construction and fixtures.

**1.03 REFERENCE STANDARDS**

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.
- C. Samples: Submit one samples, 4 by 4 inch in size illustrating color and pattern for each floor material for each color specified.
- D. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and application rate for each coat.
- F. Manufacturer's Qualification Statement.
- G. Applicator's Qualification Statement.
- H. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the work of this section.
  - 1. Minimum 3 years of documented experience.
  - 2. Approved by manufacturer.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Store resin materials in a dry, secure area.
- B. Store materials for three days prior to installation in area of installation to achieve temperature stability.

**1.07 FIELD CONDITIONS**

- A. Maintain minimum temperature in storage area of 55 degrees F.
- B. Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.

**PART 2 PRODUCTS**

**2.01 FLUID-APPLIED FLOORING SYSTEMS**

- A. Fluid-Applied Flooring: Polyurethane cement slurry base coat(s) with broadcast aggregate.
  - 1. Aggregate: Quartz granules.
  - 2. System Thickness: 1/4 inch, nominal, dry film thickness (DFT).
  - 3. Texture: Slip resistant.
  - 4. Top Coat: Aliphatic urethane protective coating.
  - 5. Sheen: Satin.
  - 6. Color: As selected by Architect from manufacturer's full range of colors.
- B. Basis of Design Product: Dur-A-Flex, Hybri-Flex EQ: [www.dur-a-flex.com](http://www.dur-a-flex.com).

1. Other Acceptable Manufacturer's:
  - a. Dudick, Inc.; SteriQuartz with Shock Crete MD/SF; [www.dudick.com](http://www.dudick.com)
  - b. Flowcrete Americas; Flowfresh SR System: [www.flowcreteamericas.com/#sle](http://www.flowcreteamericas.com/#sle).
  - c. TNEMEC; Decorative Quarz with Ultra-Tread MVT: [www.tnemecc.com/#sle](http://www.tnemecc.com/#sle).
  - d. Substitutions: See Section 01 6000 - Product Requirements.

## **2.02 ACCESSORIES**

- A. Base Caps: In rooms with tile wainscotting, see Specification 09 3000 Tiling for strips.
- B. Cant Strips: Molded of flooring resin material.
- C. Bed: Urathane Mortar product recommended by fluid-applied flooring manufacturer to achieve a 2% slope from perimeter walls to drains. Slab will be depressed 2" for this purpose.
- D. Subfloor Filler: Type recommended by fluid-applied flooring manufacturer.
- E. Primer: Type recommended by fluid-applied flooring manufacturer.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive flooring.
- C. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of materials to subfloor surfaces.
- D. Cementitious Subfloor Surfaces: Verify that substrates are ready for fluid-applied flooring installation by testing for moisture and alkalinity (pH).
  1. Obtain instructions if test results are not within limits recommended by fluid-applied flooring manufacturer.
- E. Verify that required floor-mounted utilities are in correct location.

### **3.02 PREPARATION**

- A. Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.
- B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Grind irregularities above the surface level. Prohibit traffic until filler is cured.
- C. Vacuum clean substrate.
- D. Apply primer to surfaces required by flooring manufacturer.

### **3.03 INSTALLATION - ACCESSORIES**

- A. Install cant strips at base of walls where flooring is to be extended up wall as base.
- B. Install terminating cap strip at top of base in rooms with tile wainscotting matching that of the tile install; attach securely to wall substrate. See Specification 09 3000 for strip manufacturers.

### **3.04 INSTALLATION - FLOORING**

- A. Apply in accordance with manufacturer's instructions.
- B. Apply each coat to minimum thickness required by manufacturer.
- C. Finish to smooth level surface.
- D. Cove at vertical surfaces.

### **3.05 PROTECTION**

- A. Barricade area to protect flooring until fully cured.

**3.06 SCHEDULE**

- A. Locker Rooms 311, 312, Single Use Toilet 3, & Luandry/Decon 401 all include bed material for sloping purposes: Base Bid.
- B. Vehicle Bay 400, Trunout Gear 402, SCBA Storage 403, Storage 404 & Weapons/Ammo Vault 404A all installed on flat slab: Add Alternate.

**END OF SECTION**

**SECTION 09 6813  
TILE CARPETING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Carpet tile, fully adhered.

**1.02 RELATED REQUIREMENTS**

- A. Section 09 0561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

**1.03 REFERENCE STANDARDS**

- A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016 (Reapproved 2021).

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- C. Shop Drawings: Indicate layout of joints.
- D. Samples: Submit one carpet tile illustrating color and pattern design for each carpet color selected.
- E. Accessory Samples: Submit one 3 inch long samples of edge strip.
- F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

**1.05 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

**1.06 FIELD CONDITIONS**

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Tile Carpeting:
  - 1. Basis of Design: Milliken & Company; Journal Collection in Inscription Color Line: [www.milliken.com/#sle](http://www.milliken.com/#sle).
- B. Other Manufactures that are acceptable in comparable product lines.
  - 1. Mohawk Group: [www.mohawkgroup.com/#sle](http://www.mohawkgroup.com/#sle).
  - 2. Tarkett; [www.commercial.tarkett.com](http://www.commercial.tarkett.com).
  - 3. Substitutions: See Section 01 6000 - Product Requirements.

**2.02 MATERIALS**

- A. Tile Carpeting: Tufted, Textured Loop Pile, manufactured in one color dye lot.
  - 1. Tile Size: 20 by 20 inch, nominal.
  - 2. Thickness: 0.31 inch.
  - 3. Color: As selected from manufacturer's full range, allow up to two colors.
  - 4. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
  - 5. Maximum Electrostatic Charge: 3.5 Kv. at 20 percent relative humidity.

6. Gauge: 1/12 inch.
7. Stitches: 10.0 per inch.
8. Tufts: 120/inches squared
9. Dye Method: Solution Dyed.
10. Tufted Face Weight: 15.5 oz/sq yd.
11. Light Fastness: greater than or equal to 4.0 at 80 hours.
12. Primary Backing Material: Manufacturer's cushion backing.
13. Tufted Face Weight: 15.5 oz/sq yd.

### **2.03 ACCESSORIES**

- A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.
- B. Edge Strips: Vinyl, color as selected by Architect.
- C. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
- B. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
  1. Test in accordance with Section 09 0561.
  2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.
- C. Verify that required floor-mounted utilities are in correct location.

### **3.02 PREPARATION**

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.
- C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- D. Vacuum clean substrate.

### **3.03 INSTALLATION**

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install carpet tile in accordance with manufacturer's instructions.
- C. Blend carpet from different cartons to ensure minimal variation in color match.
- D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.
- F. Fully adhere carpet tile to substrate.
- G. Trim carpet tile neatly at walls and around interruptions.
- H. Complete installation of edge strips, concealing exposed edges.

### **3.04 CLEANING**

- A. Remove excess adhesive without damage, from floor, base, and wall surfaces.
- B. Clean and vacuum carpet surfaces.

**END OF SECTION**



**SECTION 09 8430**  
**SOUND-ABSORBING WALL AND CEILING UNITS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Sound-absorbing panels.
- B. Sound-absorbing blades/linear baffles
- C. Mounting accessories.

**1.02 REFERENCE STANDARDS**

- A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2023.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- C. ASTM E795 - Standard Practices for Mounting Test Specimens during Sound Absorption Tests; 2023.

**1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's printed data sheets for products specified.
- C. Shop Drawings: Fabrication and installation details, panel layout and fabric orientation.
- D. Selection Samples: Manufacturer's color charts for fabric covering, indicating full range of fabrics, colors, and patterns available.
- E. Verification Samples: Fabricated samples of each type of panel specified; 12 by 12 inch, showing construction, edge details, and fabric covering.

**1.04 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with at least three years of documented experience.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Protect acoustical units from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until units are needed for installation.
- B. Store units flat, in dry, well-ventilated space; do not stand on end.
- C. Protect edges from damage.

**PART 2 PRODUCTS**

**2.01 FABRIC-COVERED SOUND-ABSORBING UNITS**

- A. Manufacturers:
  - 1. Acoustical Solutions: Alphasorb: [www.acousticalsolutions.com](http://www.acousticalsolutions.com)
  - 2. ATS Acoustics: [Atsacoustics.com](http://Atsacoustics.com)
  - 3. LAMVIN; SONIC PANEL: [www.lamvin.com/#sle](http://www.lamvin.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. General:
  - 1. Prefinished, factory assembled fabric-covered panels.
  - 2. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
- C. Fabric-Covered Acoustical Panels for Walls (Lobby 100, Wall Mounted):
  - 1. Panel Core: Manufacturer's standard rigid or semi-rigid fiberglass core.
  - 2. Core Density: 6 to 7 lb/cu ft.
  - 3. Panel Size: As indicated on drawings.

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and Ceiling Units

4. Panel Thickness: 2 inches.
5. Edges: Perimeter edges reinforced by a formulated resin hardener.
6. Corners: Square.
7. Fabric: Woven polyester Guilford.
8. Color: As selected by Architect from manufacturer's full range.
9. Patterns: Where fabric with directional or repeating patterns or fabric with directional weave is used, mark for installation in same direction.
10. Mounting Method: Back-mounted with mechanical fasteners.

**2.02 FIBERGLASS SOUND-ABSORBING UNITS**

- A. Manufacturers:
  1. Armstrong; Fiberglass Soundscapes Blades: [www.armstrongceilings.com](http://www.armstrongceilings.com)
  2. USG; Paraline Baffles Linear Ceiling System: [www.usg.com](http://www.usg.com)
  3. Altispace; Acoustic Blades: [www.altispace.com](http://www.altispace.com)
- B. Suspended Linear Acoustical Panels (Hall H2 and H3, suspended from structure):
  1. Sound Absorption: Noise Reduction Coefficient (NRC) of .75 when tested in accordance with ASTM C423 for Type A mounting, per ASTM E795.
  2. Composition: Fiberglass.
  3. Surface Texture: Fine.
  4. Size: 94 inches by 16 inches by 2 inches.
  5. Spacing: 18 inches on center.
  6. Edge Profile: Square.
  7. Color: as selected from manufacturer's full range.
  8. Suspension: Individually hung by aircraft cables from one side of panel.
  9. Flame Spread: Class A (UL), ASTM E1264. 25 or under.
  10. Smoke Classification: 50 or less.

**2.03 MINERAL FIBER SOUND-ABSORBING UNITS**

- A. Manufacturers:
  1. Armstrong; InvisAcoustical Ceiling Panels: [www.armstrongceilings.com](http://www.armstrongceilings.com)
  2. USG; Umbral Direct Mount Panels: [www.usg.com](http://www.usg.com)
  3. Acoustics Sound Panels: [www.acousticsoundpanels.com](http://www.acousticsoundpanels.com)
- B. Mineral Fiber Panels Direct Mounted (Lobby 100, mounted deck):
  1. Sound Absorption: Noise Reduction Coefficient (NRC) of .70 to .75 when tested in accordance with ASTM C423 for Type A mounting, per ASTM E795.
  2. Composition: Mineral Fiber.
  3. Surface Texture: Smooth.
  4. Size: 24 inches by 48 inches.
  5. Edge Profile: Square.
  6. Dimensional Stability: Antimicrobial.
  7. Attachment: screw fastened direct to structure.
  8. Flame Spread: Class A (UL), ASTM E1264.

**2.04 FABRICATION**

- A. Tolerances: Fabricate to finished tolerance of plus or minus 1/16 inch for thickness, overall length and width, and squareness from corner to corner.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Examine substrates for conditions detrimental to installation of acoustical units. Proceed with installation only after unsatisfactory conditions have been corrected.

09 8430 Sound-Absorbing Wall  
and Ceiling Units

**3.02 INSTALLATION**

- A. Install acoustical units in locations as indicated, following manufacturer's installation instructions.
- B. Install mounting accessories and supports in accordance with shop drawings.
- C. Align panels accurately, with edges plumb and top edges level. Scribe to fit accurately at adjoining work and penetrations.
- D. Install acoustical units to construction tolerances of plus or minus 1/16 inch for the following:
  - 1. Plumb and level.
  - 2. Flatness.

**3.03 CLEANING**

- A. Clean sound-absorptive panels upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

**3.04 PROTECTION**

- A. Provide protection of installed acoustical panels until Date of Final Completion.
- B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

**END OF SECTION**

**SECTION 09 9113  
EXTERIOR PAINTING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
  - 1. Fiber cement siding.
  - 2. Treated wood.
  - 3. Steel bollards, gate posts, and gate framing.
  - 4. LP gas piping.
- D. Do Not Paint or Finish the Following Items:
  - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
  - 2. Items indicated to receive other finishes.
  - 3. Items indicated to remain unfinished.
  - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
  - 5. Non-metallic roofing and flashing.
  - 6. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, zinc, and lead.
  - 7. Floors, unless specifically indicated.
  - 8. Brick, architectural concrete, and cast stone.
  - 9. Glass.
  - 10. Concealed pipes, ducts, and conduits, unless specifically indicated.

**1.02 RELATED REQUIREMENTS**

- A. Section 05 1200 - Structural Steel Framing: Avoid use of passivating coating on galvanized metals.
- B. Section 01 2300 - Alternates: Work to be performed as part of an alternate bid.
- C. Section 09 9123 - Interior Painting.

**1.03 REFERENCE STANDARDS**

- A. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.
- B. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- C. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
  - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
  - 2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples: Submit paint chip samples for color selection.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.

2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
3. Label each container with color in addition to the manufacturer's label.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

#### **1.06 FIELD CONDITIONS**

- A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- B. Primer Sealers: Same manufacturer as top coats.
- C. Substitutions: See Section 01 6000 - Product Requirements.

#### **2.02 PAINTS AND FINISHES - GENERAL**

- A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.
  1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
  2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
  3. Supply each paint material in quantity required to complete entire project's work from a single production run.
  4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.
- B. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- C. Colors: To be selected from manufacturer's full range of available colors.
  1. Selection to be made by Architect after award of contract.
  2. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Owner.
  3. Extend colors to surface edges; colors may change at any edge as directed by Architect.

#### **2.03 PAINT SYSTEMS - EXTERIOR**

- A. Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including fiber cement siding and treated wood.
  1. Two top coats and one coat primer.
  2. Top Coat(s): Exterior Latex.
    - a. Products:
      - 1) Behr Marquee Exterior Satin Enamel [No. 9450]. (MPI #15)

- 2) PPG Paints Speedhide Exterior Latex, 6-2045XI Series, Satin. (MPI #15)
- 3) Sherwin-Williams A-100 Exterior Latex Satin.
- 4) Substitutions: Section 01 6000 - Product Requirements.
3. Top Coat(s) for Primed Ferrous Metal: Exterior Light Industrial Coating, Water Based.
  - a. Products:
    - 1) Behr Premium Interior/Exterior Direct-To-Metal Paint Semi-Gloss [No. 3200]. (MPI #163)
    - 2) PPG Paints Pitt-Tech Plus DTM Industrial Enamel, 4216 HP Series, Semi-Gloss.
    - 3) Sherwin-Williams Pro Industrial Acrylic Semi-Gloss, B66-650.
    - 4) Substitutions: Section 01 6000 - Product Requirements.
4. Top Coat (s) for Galvanized Metal:
  - a. Products:
    - 1) Sherwin-Williams Pro Industrial Waterbased Acrolon 100, Gloss, B65-700 series.
5. Primer: As specified under "PRIMERS" below.

## **2.04 PRIMERS**

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
  1. Fiber Cement Siding: Alkali Resistant Water Based Primer; MPI #3.
    - a. Products:
      - 1) Behr Concrete and Masonry Bonding Primer [No. 880].
      - 2) PPG Paints Perma-Crete Interior/Exterior Alkali Resistant Primer, 4-603XI. (MPI #3)
      - 3) Sherwin-Williams Loxon Concrete and Masonry Primer Sealer, LX02W50. (MPI #3)
      - 4) Substitutions: Section 01 6000 - Product Requirements.
  2. Unprimed Ferrous Metal/Galvanized Metal: Rust-Inhibitive Water Based Primer.
    - a. Products:
      - 1) Behr Premium Plus Interior/Exterior Multi-Surface Primer and Sealer [No. 436].
      - 2) PPG Paints Pitt-Tech Plus DTM Industrial Primer, 4020 PF Series.
      - 3) Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer, B66-1300 Series.
      - 4) Substitutions: Section 01 6000 - Product Requirements.
  3. Treated Wood: Latex Primer for Exterior Wood; MPI #6.
    - a. Products:
      - 1) Behr Premium Plus Interior/Exterior Multi-Surface Primer and Sealer [No. 436]. (MPI #6)
      - 2) PPG Paints Seal Grip Interior/Exterior Acrylic Universal Primer/Sealer, 17-921XI Series. (MPI #6)
      - 3) Sherwin-Williams Exterior Latex Primer, B42W8041. (MPI #6)
      - 4) Substitutions: Section 01 6000 - Product Requirements.

## **2.05 ACCESSORY MATERIALS**

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Fastener Head Cover Material: Latex filler.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

### 3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Fiber Cement Siding: Remove dirt, dust and other foreign matter with a stiff fiber brush. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
- F. Ferrous Metal:
  - 1. Solvent clean according to SSPC-SP 1.
  - 2. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer<>. Protect from corrosion until coated.
- G. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.
- H. Galvanized Metal:
  - 1. Per manufacturer recommendations of paint prep for galvanized metals, allow galvanizing to weather for 6 months - or - clean via SSPC SP\_1 prior to painting.
    - a. Perform adhesion test prior to painting: Clean via SSPC SP-1, paint test area, let paint dry for one week, then perform an adhesion test. If test fails, contact paint manufacturer, and prepare surface per paint manufacturer's recommendations.
  - 2. GC is required to test galvanized materials for passivating coating prior to painting, as described below. If a coating is found to be present, coating must be removed at no additional cost to the Owner, via SP-1 and/or SSPC SP-16, and retested to confirm coating is removed. After removal of coating, perform paint adhesion test.
    - a. Procedure to test for passivating coating:
      - 1) Clean 6x6 inch area of the galvanized part per SSPC SP-1.
      - 2) Sand half of the test area with emery cloth, do not sand the other half.
      - 3) Use a cotton swab saturated with 2% copper sulfate solution, swipe once through the sanded and unsanded portions of the test area.
      - 4) If the sanded and unsanded areas both turn black at the same rate and in less than 10 seconds, no passivation coating is present. Clean parts per SSPC SP-1 and perform adhesion testing prior painting.
      - 5) If the unsanded area turns black at a slower rate or not at all, a passivator is present. Clean parts per SSPC SP-16 and perform adhesion testing prior to painting.

### 3.03 APPLICATION

- A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- B. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- D. Apply each coat to uniform appearance.

- E. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.
- F. Sand wood and metal surfaces lightly between coats to achieve required finish.
- G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

**3.04 CLEANING**

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

**3.05 PROTECTION**

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Final Completion.

**END OF SECTION**



**SECTION 09 9123  
INTERIOR PAINTING**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
  - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment, tape over fire rating labels prior to painting so they will be visible once painting is completed.
  - 2. Mechanical and Electrical:
    - a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
    - b. In finished areas, paint shop-primed items.
    - c. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
    - d. Paint dampers exposed behind louvers and grilles to match face panels.
- D. Do Not Paint or Finish the Following Items:
  - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
  - 2. Items indicated to receive other finishes.
  - 3. Items indicated to remain unfinished.
  - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
  - 5. Stainless steel, anodized aluminum, and bronze items.
  - 6. Floors, unless specifically indicated.
  - 7. Ceramic and other tiles.
  - 8. Brick.
  - 9. Glass.
  - 10. Acoustical materials, unless specifically indicated.
  - 11. Concealed pipes, ducts, and conduits, unless specifically indicated.

**1.02 RELATED REQUIREMENTS**

- A. Section 01 2300 - Alternates: Work to be performed as part of an alternate bid.
- B. Section 09 9113 - Exterior Painting.

**1.03 REFERENCE STANDARDS**

- A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- B. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
- C. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
  - 1. Manufacturer's product data sheets for each top coat and primer, including manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel"). Verify that top coats and primers for each paint system are listed as recommended system on product data sheets, or provide letter from paint manufacturer

- stating suitability of paint system for substrate.
- 2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples: Submit paint chip samples for color selection.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Paint and Finish Materials: 1 gallon of each color and sheen; from the same product run, store where directed.
  - 3. Label each container with color in addition to the manufacturer's label.

### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

### **1.06 FIELD CONDITIONS**

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.
- D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
- B. Paints:
  - 1. Behr Process Corporation: [www.behr.com/#sle](http://www.behr.com/#sle).
  - 2. PPG Paints: [www.ppgpaints.com/#sle](http://www.ppgpaints.com/#sle).
  - 3. Sherwin-Williams Company: [www.sherwin-williams.com/#sle](http://www.sherwin-williams.com/#sle).
- C. Primer Sealers: Same manufacturer as top coats.
- D. Substitutions: See Section 01 6000 - Product Requirements.

### **2.02 PAINTS AND FINISHES - GENERAL**

- A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
  - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
  - 2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
  - 3. Supply each paint material in quantity required to complete entire project's work from a single production run.
  - 4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

- B. Colors: To be selected from manufacturer's full range of available colors.
  - 1. Selection to be made by Architect after award of contract.
  - 2. Allow for minimum of four colors for each system, unless otherwise indicated, without additional cost to Owner.
  - 3. Extend colors to surface edges; colors may change at any edge as directed by Architect.
  - 4. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted, unless noted otherwise.

### 2.03 PAINT SYSTEMS - INTERIOR

- A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete masonry units, uncoated steel, and shop primed steel.
  - 1. Two top coats and one coat primer.
  - 2. Top Coat(s): Institutional Low Odor/VOC Interior Latex.
    - a. Products:
      - 1) Behr Premium Plus Interior Eggshell Enamel [No. 2050].
      - 2) PPG Paints Pure Performance Interior Latex, 9-310XI Series, Eggshell.
      - 3) Sherwin-Williams ProMar 200 HP Series, Low Gloss Eg-Shel.
      - 4) Substitutions: Section 01 6000 - Product Requirements.
  - 3. Primer: As recommended by top coat manufacturer for specific substrate.
- B. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals:
  - 1. Medium duty applications include doors, door frames, railings, handrails, and guardrails.
  - 2. Two top coats and one coat primer.
  - 3. Top Coat(s): Interior Light Industrial Coating Low Odor/VOC, Water Based.
    - a. Products:
      - 1) Behr Pro Pre-Catalyzed Waterborne Epoxy Semi-Gloss [No. HP150]:  
www.behr.com/#sle.
      - 2) PPG Paints Pitt-Glaze WB1 Pre-Catalyzed Water-Borne Acrylic Epoxy, 16-510 Series, Semi-Gloss.
      - 3) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Semi-Gloss.
      - 4) Substitutions: Section 01 6000 - Product Requirements.
  - 4. Primer: As recommended by top coat manufacturer for specific substrate.
- C. Paint I-OP-MD-WC - Medium Duty Vertical: Including gypsum board and concrete masonry units.
  - 1. Two top coats and one coat primer.
  - 2. Top Coat(s): Interior Light Industrial Coating Low Odor/VOC, Water Based.
    - a. Products:
      - 1) Behr Pro Pre-Catalyzed Waterborne Epoxy Eggshell [No. HP140]:  
www.behr.com/#sle.
      - 2) PPG Paints Pitt-Glaze WB1 Pre-Catalyzed Water-Borne Acrylic Epoxy, 16-310 Series, Eggshell.
      - 3) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Eg-Shel.
      - 4) Substitutions: Section 01 6000 - Product Requirements.
  - 3. Primer: As recommended by top coat manufacturer for specific substrate.
- D. Paint I-OP-DF - Dry Fall: Overhead metals; exposed structure and overhead-mounted services, including shop primed steel deck, structural steel, galvanized ducts, galvanized conduit, galvanized piping, and pre-engineered metal building framing.
  - 1. Shop primer by others.
  - 2. One top coat; white.
  - 3. Top Coat: Latex Dry Fall Low Odor/VOC.
    - a. Products:
      - 1) BEHR PRO Waterborne Acrylic Dryfall Flat No. HP210
      - 2) PPG Paints Speedhide Super Tech Water Based Interior Dry-Fog Latex, 6-725XI Series, Flat.

- 3) Sherwin-Williams Waterborne Acrylic Dryfall, Flat.
- 4) Substitutions: Section 01 6000 - Product Requirements.
- 4. Primer: As recommended by top coat manufacturer for specific substrate.

#### **2.04 ACCESSORY MATERIALS**

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Do not begin application of paints and finishes until substrates have been adequately prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- E. Test shop-applied primer for compatibility with subsequent cover materials.

#### **3.02 PREPARATION**

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.
- E. Masonry:
  - 1. Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
  - 2. Prepare surface as recommended by top coat manufacturer.
- F. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- G. Ferrous Metal:
  - 1. Solvent clean according to SSPC-SP 1.
  - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
  - 3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

#### **3.03 APPLICATION**

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

- F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.
- G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

**3.04 PROTECTION**

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Final Completion.

**3.05 SCHEDULE - PAINT SYSTEMS**

- A. Gypsum Board, CMU, Uncoated Steel and Shop Primed Steel: Finish surfaces exposed to view, except where Finish Schedule on drawings indicates "Epoxy painted". Paint shop primed structural steel beams and columns up to joist bearing elevation.
  - 1. Interior Walls and Structure: I-OP, eg-shel.
- B. Gypsum Board: Finish surfaces of interior walls exposed to view, where Finish Schedule on drawings indicates "Epoxy painted."
  - 1. Interior Walls: I-OP-MD-WC, eg-shel.
- C. Steel Doors and Door Frames: Finish surfaces exposed to view; I-OP-MD-DT, semi-gloss.
- D. Overhead Structure, Ducts, Conduits, and Pipes, U.N.O.: Finish surfaces exposed to view; I-OP-DF, flat. Coordinate sequencing with installation of metal building insulation and liner system.

**END OF SECTION**

**SECTION 10 1100  
VISUAL DISPLAY UNITS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Porcelain enamel steel markerboards.
- B. Glass markerboards.
- C. Tackboards.
- D. Bulletin board cabinets.
- E. Horizontal sliding visual display units.

**1.02 REFERENCE STANDARDS**

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).
- C. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling; 2018.
- D. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2019.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

**1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's data on porcelain enamel steel markerboard, glass markerboard, tackboard, and accessories.
- C. Samples: Color charts for selection of color and texture of porcelain enamel steel markerboard, glass markerboard, and tackboard.
- D. Manufacturer's printed installation instructions.
- E. Maintenance Data: Include data on regular cleaning and stain removal.

**PART 2 PRODUCTS**

**2.01 VISUAL DISPLAY UNITS**

- A. Magnetic Glass Markerboards: Designated on plans as "MB".
  - 1. Manufacturers:
    - a. Claridge Products and Equipment, Inc: [www.claridgeproducts.com/#sle](http://www.claridgeproducts.com/#sle).
    - b. GGI - General Glass International: [www.generalglass.com/#sle](http://www.generalglass.com/#sle).
    - c. Ghent, a GMI Company: [www.ghent.com/#sle](http://www.ghent.com/#sle).
    - d. MooreCo, Inc: [www.moorecoinc.com/#sle](http://www.moorecoinc.com/#sle).
    - e. Substitutions: See Section 01 6000 - Product Requirements.
  - 2. Glass: Laminated, low iron, 1/4 inch thick, with bevel edges and radiused corners, laminated to steel backing sheet for use with magnets. Coated or treated for use as dry erase board.
  - 3. Glass Finish: White back-coating.
  - 4. Steel Backing Sheet Thickness: 24 gauge, 0.0239 inch .
  - 5. Height: 48 inches.
  - 6. Length: 48 inches, in one piece.
  - 7. Frame: No frame, with concealed fasteners.
  - 8. Mounting: Concealed Z clips.
  - 9. Accessories: Provide magnetic marker tray and magnetic marker holder.
- B. Tackboards: Fine-grained, homogeneous natural cork. Designated on plans as "TB".
  - 1. Manufacturers:
    - a. AJW Architectural Products: [www.ajw.com/#sle](http://www.ajw.com/#sle).

- b. ASI Visual Display Products: [www.asi-visualdisplayproducts.com/#sle](http://www.asi-visualdisplayproducts.com/#sle).
  - c. Nelson Adams NACO: [www.nelsonadamsnaco.com/#sle](http://www.nelsonadamsnaco.com/#sle).
  - d. Substitutions: See Section 01 6000 - Product Requirements.
- 2. Cork Thickness: 1/8 inch.
- 3. Backing: Hardboard, 1/4 inch thick, laminated to tack surface.
- 4. Surface Burning Characteristics: Flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.
- 5. Height: 48 inches.
- 6. Length: 48 inches , in one piece.
- 7. Frame: Extruded aluminum , with concealed fasteners.
- 8. Frame Finish: Anodized, natural.
- C. Bulletin Board Cabinets: Factory-fabricated aluminum-framed unit with tackable panel on back inside surface and glazed doors at front. Designated on plans as "BCC".
  - 1. Manufacturers:
    - a. Claridge Products and Equipment, Inc: [www.claridgeproducts.com/#sle](http://www.claridgeproducts.com/#sle).
    - b. Ghent, a GMI Company: [www.ghent.com/#sle](http://www.ghent.com/#sle).
    - c. Platinum Visual Systems: [www.pvsusa.com/#sle](http://www.pvsusa.com/#sle).
  - 2. Width: 6 feet.
  - 3. Height: 4 feet.
  - 4. Depth: 3 inches.
  - 5. Aluminum Frames: Extruded aluminum, with concealed fasteners. Anodized, natural finish.
  - 6. Frame Profile: Square frame section with square cabinet corners.
  - 7. Components:
    - a. Glazed Doors: Sliding, tempered glass.
      - 1) Number of Doors: One pair.
    - b. Tackable Back Panel: Fine-grained, homogeneous natural cork.

## 2.02 MATERIALS

- A. Porcelain Enameled Steel Sheet: ASTM A424/A424M, Type I, Commercial Steel, with fired-on vitreous finish.
- B. Float Glass: Provide float-glass-based glazing unless otherwise indicated.
  - 1. Fully Tempered Safety Glass: Comply with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
- C. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
  - 1. Laminated Safety Glass: Comply with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.

## 2.03 ACCESSORIES

- A. Marker Tray: Aluminum, manufacturer's standard profile, one piece full length of markerboard, molded ends, concealed fasteners, same finish as frame.
- B. Mounting Brackets: Concealed.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

### 3.02 INSTALLATION

- A. Install boards in accordance with manufacturer's instructions.
- B. Secure units level and plumb.

**3.03 CLEANING**

- A. Clean board surfaces in accordance with manufacturer's instructions.

**END OF SECTION**



**SECTION 10 1200  
DISPLAY CASES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Recessed display cases.
- B. Free-standing display cases.

**1.02 RELATED REQUIREMENTS**

- A. Section 09 2116 - Gypsum Board Assemblies: Concealed supports in metal stud walls.
- B. Section 09 2216 - Non-Structural Metal Framing: Concealed supports in metal stud walls.

**1.03 REFERENCE STANDARDS**

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit complete printed data and installation details indicating products to be provided as specified.
  - 1. Submit color charts for selection by the Architect.
- C. Shop Drawings: Submit complete installation details. Include dimensioned elevations.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.

**1.06 DELIVERY, STORAGE AND HANDLING**

- A. Deliver display cases and materials to the Project site with manufacturer's protective crate covering and do not open until ready for use.
- B. Protect display cases before, during, and after installation. In case of damage, immediately provide necessary repairs and replacements.

**1.07 FIELD CONDITIONS**

- A. Field Measurements: Verify field measurements for existing conditions where display case is to be installed before preparation of shop drawings and before fabrication to ensure proper installation.

**1.08 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty against defects and in materials, finish product and workmanship.

**PART 2 PRODUCTS**

**2.01 DISPLAY CASES**

- A. Manufacturers:
  - 1. Relicase: <https://www.relicase.com/products/freestanding-display-cases/621>
  - 2. Caseworks: <https://www.caseworks.com/products/exhibit-furnishings>
  - 3. Mayvaert: <https://www.meyvaert.com/en/products>
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Free Standing Display Case Custom Fitted Into Existing Conditions: Factory-fabricated frameless glass display case with opaque top to include integral lighting, and standard pedestal base constructed of MDF or Steel with levelers.
  - 1. Width: 5 feet.
  - 2. Height: As indicated on drawings.
  - 3. Depth: 30 inches.

4. Components:
  - a. Glazed Doors: Hinged.
  - b. Side Panels: Glass.
  - c. Back Panel: Glass.
  - d. Top Panel: Laminate-faced substrate.
  - e. Bottom Panel: Laminate-faced substrate.
  - f. Lighting: LED.

## **2.02 COMPONENTS**

- A. Case it to consist of a base, lower opaque section, four sided glass viewing section, and an opaque top section. See drawings for details.
  1. Base: Standard steel or MDF with HPL overlay (colors to be selected by architect from manufacturers full line).
  2. Lower Section: Standard steel or MDF with HPL overlay (colors to be selected by architect from manufacturers full line).
  3. Glass Section: See glass below.
  4. Top Section: Standard steel or MDF with HPL overlay (colors to be selected by architect from manufacturers full line).
- B. Glass:
  1. Clear white laminated, non-reflective, UV protecting/safety glass.
  2. Hinged access door for full and convenient access.
    - a. Provide all necessary mechanisms and hardware to provide safe and convenient access for a minimum of personnel.
- C. Lighting: Manufacturer's standard LED light fixtures housed at top of case with louvered aluminum access door with keyed lock.
  1. Controls: On/Off using dedicated wall switch.
  2. 120V power will be provided to Display Case location, if LED lighting requires 12V it will need to be provided by the Display Case Manufacture.
- D. Humidity Control: Airtight sealed case with passive relative humidity regulation through silica gel cassettes in an externally accessible drawer in the base of the showcase.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Coordinate installation with existing on-site conditions (case will be installed around a steel column).
- C. Clean case and glass using manufacturers recommended procedures.
- D. Provide mitered and wrapped hairline joints for all trims.

### **3.02 ADJUSTING AND CLEANING**

- A. Verify that all accessories are installed as detailed for each unit.
- B. At completion of work, clean glass surfaces, and trim in accordance with manufacturer's recommendations leaving units ready for use.

### **3.03 CLOSEOUT ACTIVITIES**

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

## **END OF SECTION**

**SECTION 10 1416  
PLAQUES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Plaques.

**1.02 REFERENCE STANDARDS**

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

**1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate dimensions, locations, elevations, materials, text and graphic layout, and attachment details.
- C. Manufacturer's qualification statement.

**1.04 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Package plaque signs as required to prevent damage before installation.
- B. Store inside.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Plaques:
  - 1. Cosco Industries; Cast Aluminum: [www.coscoarchitecturalsigns.com](http://www.coscoarchitecturalsigns.com).
  - 2. Geminin Plaques; Cast Aluminum: [www.geminiplaques.com](http://www.geminiplaques.com).
  - 3. Impact Signs; Cast Aluminum: [www.impactsigns.com](http://www.impactsigns.com)
  - 4. Mathews Architectural Products; Cast Aluminum: [www.mathewsid.com](http://www.mathewsid.com)
  - 5. Substitutions: See Section 01 6000 - Product Requirements.

**2.02 REGULATORY REQUIREMENTS**

- A. Accessibility Requirements: Comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most restrictive requirements.

**2.03 PLAQUES**

- A. Metal Plaques: Designated on plans as "PL".
  - 1. Material: Aluminum casting.
  - 2. Size: 20 inches by 30 inches.
  - 3. Text and Typeface:
    - a. Character Font: Helvetica, Arial, or other sans serif font.
    - b. Character Case: Upper and lower case (title case).
    - c. Character Color: Contrast with background color.
    - d. Text: to be provided by Architect prior to submittal.
  - 4. Border Style: Single line boarder profile, brushed aluminum finish.
  - 5. Background Texture: Matte.
  - 6. Surface Finish: Brushed, satin.
  - 7. Painted Background Color: As selected by Architect from manufacturer's standard background colors.

- 8. Mounting: Blind studs.

**2.04 ACCESSORIES**

- A. Concealed Screws: Noncorroding metal; stainless steel.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify that substrate surfaces are ready to receive work.
- B. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

**3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install with horizontal edges level.
- C. Protect from damage until mm-dd-yyyy; repair or replace damaged items.

**END OF SECTION**

**SECTION 10 1419  
DIMENSIONAL LETTER SIGNAGE**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Dimensional letter signage.
- B. Illumination system.

**1.02 REFERENCE STANDARDS**

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 879 - Electric Sign Components; Current Edition, Including All Revisions.

**1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's product literature for each type of dimensional letter sign, indicating style, font, colors, locations, and overall dimensions of each sign.
- C. Shop Drawings:
  - 1. Include dimensions, locations, elevations, materials, text and graphic layout, and attachment details.
  - 2. Show locations of electrical service connections.
  - 3. Include diagrams for power, signal, and control wiring.
- D. Samples: Submit one sample of each type of dimensional letter sign of size similar to that required for project, indicating sign style, font, and method of attachment.
- E. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

**1.04 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Package dimensional letter signs as required to prevent damage before installation.
- B. Store under cover and elevated above grade.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Dimensional Letter Signs:
  - 1. Gemini Sign Letters: [www.geminisignletters.com](http://www.geminisignletters.com).
  - 2. FASTSIGNS International, Inc: [www.fastsigns.com/#sle](http://www.fastsigns.com/#sle).
  - 3. Takeform: [www.takeform.net/#sle](http://www.takeform.net/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.

**2.02 REGULATORY REQUIREMENTS**

- A. Accessibility Requirements: Comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most restrictive requirements.

**2.03 DIMENSIONAL LETTERS**

- A. Applications: Building identification.
  - 1. Use individual metal letters.

10 1419 Dimensional Letter  
Signage

2. Mounting Location: Exterior as indicated on drawings.
- B. Metal Letters:
  1. Material: Aluminum sheet, flat.
  2. Thickness: 3/8 inch minimum.
  3. Letter Height: As indicated on drawings.
  4. Text and Typeface:
    - a. Character Font: Helvetica, Arial, or other sans serif font.
    - b. Character Case: Upper case only.
  5. Finish: Brushed, satin.
  6. Color: As selected.
  7. Mounting: Concealed screws.
  8. Illumination System: Halo-lit reverse channel letters.
    - a. Provide products that are listed and labeled as complying with UL 879, where applicable.
    - b. Power: 120 V, 60 Hz, 1 phase, 15 A.

**2.04 ACCESSORIES**

- A. Concealed Screws: Noncorroding metal; stainless steel, galvanized steel, chrome plated, or other.
- B. Electrical Components and Devices: Listed and labeled as defined in NFPA 70 by a qualified testing agency.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify that substrate surfaces are ready to receive work.
- B. Verify that electrical service is correctly sized and located to accommodate dimensional letter signs.
- C. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

**3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install with horizontal edges level.
- C. Locate dimensional letter signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
- D. Protect from damage until mm-dd-yyyy; repair or replace damaged items.

**END OF SECTION**

**SECTION 10 1423  
PANEL SIGNAGE**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Panel signage.

**1.02 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

**1.03 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's product literature for each type of panel sign, indicating styles, font, foreground and background colors, locations, and overall dimensions of each sign.
- C. Shop Drawings:
  - 1. Include dimensions, locations, elevations, materials, text and graphic layout, attachment details, and schedules.
  - 2. Schedule: Provide information sufficient to completely define each panel sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
    - a. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
    - b. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
    - c. Submit for approval by Owner through Architect prior to fabrication.
- D. Selection Samples: Where colors, materials, and finishes are not specified, submit two sets of color selection charts or chips.
- E. Manufacturer's Installation Instructions: Include installation templates and attachment devices.
- F. Manufacturer's qualification statement.

**1.04 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Package signs as required to prevent damage before installation.
- B. Package room and door signs in sequential order of installation, labeled by floor or building.
- C. Store tape adhesive at normal room temperature.

**1.06 FIELD CONDITIONS**

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain minimum ambient temperature during and after installation.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Panel Signage:
  - 1. Best Sign Systems, Inc: [www.bestsigns.com/#sle](http://www.bestsigns.com/#sle).
  - 2. FASTSIGNS International, Inc: [www.fastsigns.com/#sle](http://www.fastsigns.com/#sle).
  - 3. Inpro Corporation: [www.inprocorp.com/#sle](http://www.inprocorp.com/#sle).
  - 4. Mohawk Sign Systems, Inc: [www.mohawksign.com/#sle](http://www.mohawksign.com/#sle).
  - 5. Takeform: [www.takeform.net/#sle](http://www.takeform.net/#sle).

6. Substitutions: See Section 01 6000 - Product Requirements.

## **2.02 REGULATORY REQUIREMENTS**

- A. Accessibility Requirements: Comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most restrictive requirements.

## **2.03 PANEL SIGNAGE**

- A. Panel Signage:
  1. Application: Room and door signs. Provide a sign for every doorway, wheather it has a door or not, not including corridors, lobbies, fire rated doors, and similar open areas.
  2. Description: Flat signs with engraved panel media, tactile characters.
  3. Sign Size: 4 inches by 6 inches.
  4. Total Thickness: 1/8 inch.
  5. Sign Edges: Squared.
  6. Letter Edges: Squared.
  7. Corners: Squared.
  8. Color and Font, unless otherwise indicated:
    - a. Character Font: Helvetica, Arial, or other sans serif font.
    - b. Character Case: Upper and lower case (title case).
    - c. Background Color: As selected from manufactures full range of colors.
    - d. Character Color: Contrasting color.
  9. Material: Laminated colored plastic engraved through face to expose core as background color.
  10. Profile: Flat panel in aluminum frame.
    - a. Frame Finish: Natural (clear) anodized.
  11. Tactile Letters: Raised 1/32 inch minimum.
  12. Braille: Grade II, ADA-compliant.
  13. One-Sided Wall Mounting: Tape adhesive. If sign occurs on glass provide backing plate on opposite side to conceal sign fastening.

## **2.04 SIGNAGE APPLICATIONS**

- A. Room and Door Signs:
  1. Office Doors: Identify with room names and numbers to be determined later, not those indicated on drawings; provide "window" section for replaceable occupant name.
  2. Conference and Meeting Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings; provide "window" section with sliding "In Use/Vacant" indicator.
  3. Classrooms and Training Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
  4. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
  5. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers to be determined later,.
  6. Exit Signs: Identify exit doors with the name "Exit".
- B. Emergency Evacuation Map Panel Signs:
  1. Allow for 3 maps.
  2. Map content to be provided by Owner.
- C. Fire Rated Door Signs:
  1. Identify with "Fire Rated Door - Keep Closed At All Times.

## **2.05 ACCESSORIES**

- A. Tape Adhesive: Double-sided tape, permanent adhesive.



**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify that substrate surfaces are ready to receive work.
- B. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

**3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install with horizontal edges level.
- C. Locate panel signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
- D. Protect from damage until mm-dd-yyyy; repair or replace damaged items.

**END OF SECTION**

**SECTION 10 2113.17  
PHENOLIC TOILET COMPARTMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Phenolic toilet compartments.
- B. Urinal screens.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 1000 - Rough Carpentry: Blocking and supports.

**1.03 REFERENCE STANDARDS**

- A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on panel construction, hardware, and accessories.
- C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.
- D. Samples: Submit one samples chain showing all available colors of partition panels, 2 by 2 inch in size illustrating panel finish, color, and sheen.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Phenolic Toilet Compartments:
  - 1. All American Metal Corp - AAMCO: [www.allamericanmetal.com/#sle](http://www.allamericanmetal.com/#sle).
  - 2. ASI Accurate Partitions: [www.asi-accuratepartitions.com/#sle](http://www.asi-accuratepartitions.com/#sle).
  - 3. Bradley: [www.bradleycorp.com](http://www.bradleycorp.com)
  - 4. Partition Systems International of South Carolina; Phenolic Toilet Partitions: [www.psisc.com/#sle](http://www.psisc.com/#sle).
  - 5. Substitutions: Section 01 6000 - Product Requirements.

**2.02 PHENOLIC TOILET COMPARTMENTS**

- A. Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid phenolic core panels with integral melamine finish, floor-mounted headrail-braced.
  - 1. Color: Two colors as selected.
- B. Doors:
  - 1. Thickness: 3/4 inch.
  - 2. Width: 24 inch.
  - 3. Width for Handicapped Use: 36 inch, out-swinging.
  - 4. Height: 58 inch.
- C. Panels:
  - 1. Thickness: 1/2 inch.
  - 2. Height: 58 inch.
  - 3. Depth: As indicated on drawings.
- D. Pilasters:
  - 1. Thickness: 3/4 inch.
  - 2. Width: As required to fit space; minimum 3 inch.

10 2113.17 Phenolic Toilet  
Compartments

- E. Screens: Without doors; to match compartments; mounted to wall with continuous panel brackets with vertical support/bracing same as compartments.

### **2.03 ACCESSORIES**

- A. Pilaster Shoes: Formed ASTM A666 Type 304 stainless steel with No. 4 finish, 3 inch high, concealing floor fastenings.
- B. Head Rails: Hollow stainless steel, 1 inch by 1-1/2 inch size, with anti-grip profile and cast socket wall brackets.
- C. Wall and Pilaster Brackets: Polished stainless steel; continuous type.
- D. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.
- E. Hardware: Polished stainless steel:
  - 1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
  - 2. Door Latch: Slide type with exterior emergency access feature and occupancy indicator.
  - 3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
  - 4. Coat hook with rubber bumper; one per compartment, mounted on door.
  - 5. Provide door pull for outswinging doors.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify correct spacing of and between plumbing fixtures.
- C. Verify correct location of built-in framing, anchorage, and bracing.

### **3.02 INSTALLATION**

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Maintain 3/8 inch to 1/2 inch space between wall and panels and between wall and end pilasters.
- C. Attach panel brackets securely to walls using anchor devices.
- D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.
- E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

### **3.03 TOLERANCES**

- A. Maximum Variation From True Position: 1/4 inch.
- B. Maximum Variation From Plumb: 1/8 inch.

### **3.04 ADJUSTING**

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.
- B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.
- C. Adjust adjacent components for consistency of line or plane.

**END OF SECTION**

**SECTION 10 2600  
WALL AND DOOR PROTECTION**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Corner guards.
- B. Protective wall covering.

**1.02 RELATED REQUIREMENTS**

**1.03 REFERENCE STANDARDS**

- A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2023, with Editorial Revision.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- C. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies; 2023.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.
- C. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
  - 1. Submit one section of corner guards, 6 inches inches long.
  - 2. Submit one sample of protective wall covering, 6 by 6 inches square.
- D. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.
- E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.
- B. Protect work from UV light damage.
- C. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.

**1.06 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer Warranty: Provide 5-year manufacturer warranty for metal crash rails. Complete forms in Owner's name and register with manufacturer.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Protective Wall Covering:
  - 1. Basis of Design: Construction Specialties, Inc; Acrovyn 4000 Rigid Sheet: [www.c-sgroup.com/#sle](http://www.c-sgroup.com/#sle).
  - 2. Other acceptable manufactures:
    - a. Inpro; Palladium Rigid Sheet: [www.inprocorp.com/#sle](http://www.inprocorp.com/#sle).
    - b. Koroseal; Korogard Sheets: [www.koroseal.com](http://www.koroseal.com).
  - 3. Substitutions: See Section 01 6000 - Product Requirements.

## **2.02 PERFORMANCE CRITERIA**

- A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.

## **2.03 PRODUCT TYPES**

- A. Protective Wall Covering:
  - 1. Material: High-impact acrylic-modified vinyl.
  - 2. Thickness: 0.040 inch.
  - 3. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
  - 4. Color: As selected from manufacturer's full range of colors. Two colors to be selected.
  - 5. Custom Imagery: Add Alternate.
  - 6. Texture: Suede.
  - 7. Accessories: Provide manufacturer's standard aluminum trim and moldings with radius profile.
    - a. Inside Corner Trim
    - b. Outside Corner Trim
    - c. Top Trim
  - 8. Mounting: Adhesive.

## **2.04 FABRICATION**

- A. Fabricate components with tight joints, corners and seams.

## **2.05 SOURCE QUALITY CONTROL**

- A. See Section 01 4000 - Quality Requirements, for additional requirements.

# **PART 3 EXECUTION**

## **3.01 EXAMINATION**

- A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.
- B. Verify that field measurements are as indicated on drawings.
- C. Verify that substrate surfaces for adhered items are clean and smooth.
  - 1. Test painted or wall covering surfaces for adhesion in inconspicuous area, as recommended by manufacturer. Follow adhesive manufacturer's recommendations for remedial measures at locations and/or application conditions where adhesion test's results are unsatisfactory.
- D. Start of installation constitutes acceptance of project conditions.

## **3.02 INSTALLATION**

- A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.
- B. Position corner guard on top of wall base.
- C. Position protective wall covering on top of wall base.
  - 1. Full-Height Installation: Establish a plumb line located at edge of starting point of first sheet to ensure following sheets will be installed plumb.
  - 2. Wainscot Installation: Establish a level line at the specified height for entire length of run. Install by aligning top of edge of covering with this line.
  - 3. Apply adhesive with 1/8 inch V-notch trowel to an area of wall surface that can be completed within cure time of the adhesive.
  - 4. Install trim pieces as required for a complete installation. Allow tolerance for thermal movement.
  - 5. At vertical joints between sections, butt tight together with no trim.
  - 6. Use a roller to ensure maximum contact with adhesive.

7. At inside and outside corners cut covering sheets to facilitate installation of trim pieces or corner guards.

**3.03 TOLERANCES**

- A. Maximum Variation From Required Height: 1/4 inch.
- B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

**3.04 CLEANING**

- A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

**END OF SECTION**

**SECTION 10 2800  
TOILET, BATH, AND LAUNDRY ACCESSORIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Commercial toilet accessories.
- B. Commercial shower and bath accessories.
- C. Utility room accessories.

**1.02 RELATED REQUIREMENTS**

**1.03 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2022.
- C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.
- D. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2017 (Reapproved 2022).
- E. ASTM C1036 - Standard Specification for Flat Glass; 2021.
- F. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2024.
- G. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

**1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

**1.05 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Commercial Toilet, Shower, and Bath Accessories: Basis of Design products listed below by Bobrick, unless noted otherwise. See drawings for schedule of items to be furnished by Owner and Installed by Contractor.
  - 1. Other acceptable manufacturers:
    - a. AJW Architectural Products: [www.ajw.com/#sle](http://www.ajw.com/#sle).
    - b. American Specialties, Inc: [www.americanspecialties.com/#sle](http://www.americanspecialties.com/#sle).
    - c. Bradley Corporation: [www.bradleycorp.com/#sle](http://www.bradleycorp.com/#sle).
    - d. Georgia-Pacific Professional: [www.gppro.com/#sle](http://www.gppro.com/#sle).

**2.02 MATERIALS**

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
  - 1. Grind welded joints smooth.
  - 2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.
- B. Stainless Steel Sheet: ASTM A666, Type 304.
- C. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- D. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

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Accessories

- E. Fasteners, Screws, and Bolts: Stainless steel or Hot dip galvanized; tamper-proof; security type.

**2.03 FINISHES**

- A. Stainless Steel: Satin finish, unless otherwise noted.
- B. Chrome/Nickel Plating: ASTM B456, SC 2, polished finish, unless otherwise noted.

**2.04 COMMERCIAL TOILET ACCESSORIES**

- A. Waste Receptacle: Stainless steel, freestanding style funnel top.
  - 1. Liner: Removable rigid molded plastic receptacle.
  - 2. Minimum capacity: 33 gallons.
  - 3. Products:
    - a. Model B-2400 by Bobrick.
- B. Mirrors: Stainless steel framed, 1/4 inch thick annealed float glass; ASTM C1036.
  - 1. Size: Standard 24 by 36 inch, Full Length 24 by 60 inch.
  - 2. Frame: 0.05 inch angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
  - 3. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and nonabsorptive filler material.
  - 4. Products:
    - a. Model 290 by Bobrick.
- C. Grab Bars: Stainless steel, textured surface.
  - 1. Standard Duty Grab Bars:
    - a. Push/Pull Point Load: 250 pound-force, minimum.
    - b. Dimensions: 1-1/2 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
    - c. Length and Configuration: As indicated on drawings.
    - d. Products:
      - 1) Model B-5806 by Bobrick.

**2.05 COMMERCIAL SHOWER AND BATH ACCESSORIES**

- A. Shower Curtain Rod: Stainless steel tube, 1-1/4 inch outside diameter, 0.04 inch wall thickness, satin-finished, with 3 inch outside diameter, minimum 0.04 inch thick satin-finished stainless steel flanges, for concealed mounting.
  - 1. Products:
    - a. Model 6047 by Bobrick.
- B. Shower Curtain:
  - 1. Material: Opaque vinyl, 0.008 inch thick, matte finish, with antibacterial treatment, flameproof and stain-resistant.
  - 2. Size: 12 inches larger than opening and 72 inches high, hemmed edges.
  - 3. Grommets: Stainless steel; pierced through top hem on 6 inch centers.
  - 4. Color: White.
  - 5. Shower Curtain Hooks: Stainless steel spring wire designed for snap closure.
  - 6. Products:
    - a. Shower Curtain: Model 204-2 or 204-3 by Bobrick.
    - b. Curtain Hooks: Model 204-1 by Bobrick.
- C. Folding Shower Seat: Wall-mounted surface; welded tubular seat frame, structural support members, swing-down legs, hinges, and mechanical fasteners of Type 304 stainless steel, rectangular seat.
  - 1. Seat: Phenolic or polymeric composite one-piece seat or seat slats, of color as selected.
  - 2. Size: ADA Standards compliant.
  - 3. Products:
    - a. Model B-5181 by Bobrick.



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Accessories

- D. Wall-Mounted Soap Dish: Heavy duty, seamless stainless steel, surface-mounted with drain holes, without grab bar, satin finish; with concealed mechanical fastening suitable for substrate and backplate.
  - 1. Products:
    - a. Model B-680 by Bobrick.
- E. Robe Hook: Heavy-duty stainless steel, double-prong, rectangular-shaped bracket and backplate for concealed attachment, satin finish.
  - 1. Products:
    - a. Model B6827 by Bobrick.

**2.06 UTILITY ROOM ACCESSORIES**

- A. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.
  - 1. Hooks: Two, 0.06 inch stainless steel rag hooks at shelf front.
  - 2. Mop/broom holders: Four spring-loaded rubber cam holders at shelf front.
  - 3. Length: 36 inches.
  - 4. Products:
    - a. Model B-224 x 36 by Bobrick.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.

**3.02 PREPARATION**

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

**3.03 INSTALLATION**

- A. Install plumb and level, securely and rigidly anchored to substrate.
- B. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
  - 1. Grab Bars: As indicated on drawings.
  - 2. Mirrors: As indicated on drawings.

**3.04 PROTECTION**

- A. Protect installed accessories from damage due to subsequent construction operations.

**END OF SECTION**

**SECTION 10 4400  
FIRE PROTECTION SPECIALTIES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.
- C. Accessories.

**1.02 RELATED REQUIREMENTS**

**1.03 REFERENCE STANDARDS**

- A. NFPA 10 - Standard for Portable Fire Extinguishers; 2022.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide extinguisher operational features, color and finish, anchorage details, and installation instructions.
- C. Shop Drawings: Indicate cabinet physical dimensions and accessories required for complete installation.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Fire Extinguishers:
  - 1. Ansul, a Tyco Business: [www.ansul.com/#sle](http://www.ansul.com/#sle).
  - 2. Kidde, a unit of United Technologies Corp: [www.kidde.com/#sle](http://www.kidde.com/#sle).
  - 3. Nystrom, Inc: [www.nystrom.com/#sle](http://www.nystrom.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Fire Extinguisher Cabinets and Accessories:
  - 1. Activar Construction Products Group, Inc. - JL Industries; Ambassador Series: [www.activarcpg.com/#sle](http://www.activarcpg.com/#sle).
  - 2. Larsen's Manufacturing Co: [www.larsensmfg.com/#sle](http://www.larsensmfg.com/#sle).
  - 3. Nystrom, Inc: [www.nystrom.com/#sle](http://www.nystrom.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.

**2.02 FIRE EXTINGUISHERS**

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
- B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
  - 1. Class: A:B:C type.
  - 2. Size: 5 pound.
  - 3. Temperature range: Minus 40 degrees F to 120 degrees F.

**2.03 FIRE EXTINGUISHER CABINETS**

- A. Cabinet Construction: Non-fire rated.
- B. Cabinet Configuration: Recessed type.
  - 1. Size to accommodate accessories.
  - 2. Trim: Flat square edge, with 1.25 inch wide face.
- C. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with continuous piano hinge.
- D. Door Glazing: Acrylic plastic, clear, 1/8 inch thick, flat shape and set in resilient channel glazing gasket.

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Specialties

- E. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.
- F. Finish of Cabinet Exterior Trim and Door: No.4 - Brushed stainless steel.
- G. Finish of Cabinet Interior: White colored enamel.

**2.04 ACCESSORIES**

- A. Lettering: "FIRE EXTINGUISHER" decal, or vinyl self-adhering, prespaced black lettering in accordance with authorities having jurisdiction (AHJ).

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

**3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level in wall openings, 48 inches from finished floor to cabinet handle and fire extinguisher handle.
- C. Secure rigidly in place.
- D. Place extinguishers in cabinets and on wall bracket.

**END OF SECTION**

**SECTION 10 5129  
PHENOLIC LOCKERS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Phenolic lockers.
- B. Locker benches.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 3000 - Cast-in-Place Concrete Concrete base construction.

**1.03 REFERENCE STANDARDS**

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's published data on locker construction, sizes and accessories.
- C. Shop Drawings: Indicate locker plan layout, numbering plan.
- D. Samples: Submit one sample 3 by 6 inches in size, of each color.

**1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Protect locker finish and adjacent surfaces from damage.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Phenolic Lockers:
  - 1. ASI Storage Solutions: [www.asi-storage.com/#sle](http://www.asi-storage.com/#sle).
  - 2. Columbia Lockers, a division of PSiSC; Phenolic Lockers: [www.psisc.com/#sle](http://www.psisc.com/#sle).
  - 3. Summit Lockers, Inc: [www.summitlockers.com/#sle](http://www.summitlockers.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.

**2.02 LOCKER APPLICATIONS**

- A. Locker Room Lockers: Phenolic lockers, free-standing for base indicated on drawings.
  - 1. Width: 15 inches.
  - 2. Depth: 18 inches.
  - 3. Height: 72 inches.
  - 4. Locker Configuration: Two tier.
  - 5. Fittings: Size and configuration as indicated on drawings.
    - a. Hooks: One double prong.
  - 6. Ventilation: By open space between the back of the door and locker body.
  - 7. Locking: Padlock hasps, for padlocks provided by Owner. Hasps to be operable by closed fist.
  - 8. Provide sloped top.
- B. Locker Benches: Stationary type; bench top of phenolic material; painted steel pedestals.
  - 1. Accessibility: Comply with ICC A117.1 and ADA Standards.
  - 2. Length: 36, 48, 72 inch, per drawings.

**2.03 PHENOLIC LOCKERS**

- A. Lockers: Factory assembled, made of phenolic core panels with mortise and tenon joints and stainless steel mechanical joint fasteners; fully finished inside and out; each locker capable of standing alone.

1. Doors: Full overlay, covering full width and height of locker body; square edges.
  2. Panel Core Exposed at Edges: Machine polished, without chips or tool marks; square edge unless otherwise indicated.
  3. Where locker ends or sides are exposed, finish the same as fronts or provide extra panels to match fronts.
  4. Provide filler strips where indicated, securely attached to lockers.
  5. Door Color: As selected by Architect; allow for 2 different colors.
  6. Body Color: Manufacturer's standard black.
  7. Fasteners for Accessories and Locking Mechanisms: Tamperproof type.
- B. Component Thicknesses:
1. Doors: 1/2 inch minimum thickness.
  2. Locker Body: One of the following combinations:
    - a. Tops, bottoms, and shelves 1/2 inch; sides 3/8 inch; backs 1/4 inch; minimum.
  3. End Panels and Filler Panels: 1/2 inch minimum thickness.
  4. Sloped Tops: 1/2 inch minimum thickness.
- C. Phenolic Core Panels: Nonporous phenolic resin and paper core formed under high pressure, with natural colored finished edges, integral melamine surface, matte finish, and uniform surface appearance; glued laminated panels not acceptable.
1. Surface Burning Characteristics: Flame spread index of 75 or less, and smoke developed index of 450 or less; when tested in accordance with ASTM E84.
- D. Hinges: Stainless steel, satin finish; minimum of 90 degree opening; either exposed barrel 5-knuckle hinge attached to back of door and inside of body with tamperproof screws, or concealed cabinet style hinge attached with tamperproof screws.
- E. Coat Hooks: Stainless steel or reinforced nylon; attached with tamperproof screws.
- F. Number Plates: Manufacturer's standard, minimum 4-digit, permanently attached with adhesive; may be field installed.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that prepared bases are in correct position and configuration.
- B. Verify bases and embedded anchors are properly sized.

#### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install lockers plumb and square.
- C. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 pounds.
- D. Bolt adjoining locker units together to provide rigid installation.
- E. Install end panels, filler panels, and sloped tops.
- F. Install accessories.
- G. Replace components that do not operate smoothly.

#### **3.03 CLEANING**

- A. Clean locker interiors and exterior surfaces.

#### **END OF SECTION**

**SECTION 10 6000  
WOOD STORAGE SHELVING**

**PART 1.0 GENERAL**

**1.01 DESCRIPTION**

- A. Pre-manufactured wood storage shelving.

**1.02 SUBMITTALS**

- A. Shop Drawings:
  - 1. Submit shop drawings for storage units, identified with location, materials and finishes.
  - 2. Indicate materials, methods of assembly and jointing, thickness of parts, location and type of hardware.
  - 3. Take measurements at the site for space where each item is to be placed.
- B. Product Data: Submit manufacturer's detailed product description. Indicate unit construction including finishes.

**1.03 DELIVERY, STORAGE AND HANDLING**

- A. Deliver storage units only after building is enclosed and wet operations in building are completed.
- B. Protect finished surfaces from soiling and damage during handling and installation.

**PART 4.0 PRODUCTS**

**4.01 ACCEPTABLE MANUFACTURERS**

- A. Excalibur Shelving Systems; Standard Pine: [www.excaliburshelvingsystems.com](http://www.excaliburshelvingsystems.com).
- B. Lundia USA; Stockroom Shelving: [www.lundiausa.com](http://www.lundiausa.com).
- C. Newood Manufacturing Inc; Stockroom Shelving: [www.newood.com](http://www.newood.com).
- D. Substitutions: See Section 01 6000 - Product Requirements.

**4.02 MATERIALS AND COMPONENTS**

- A. Uprights: Hemlock or Douglas Fir (1-5/8" x 1-5/8")
  - 1. 3/8" x 5/8" deep plow entire length of stiles to receive shelf end channels with 3/16" drilled holes on 1" centers. Uprights to be sufficient height for shelving to be 7'-0" high
  - 2. Stiles are to be locked together with three or more cross members mortised glued and pinned into the stiles

**4.03 ALL COMPONENTS ARE TO BE MACHINED SMOOTH WITH ALL OUTSIDE CORNERS EASED**

**4.04 SHELVES: 3/4" PINE SHELF MATERIALS ARE TO BE MACHINED TO ACCEPT ROLL FORMED STEEL END CHANNELS SHAPED TO FIT OVER EACH END OF THE SHELF AND TO REST ON THE SHELF SUPPORT PINS. FINGER JOINTS ARE NOT ACCEPTABLE.**

- A. Seven (7) shelves per section unless otherwise specified.
- B. Shelf Support Pins: Non rusting alloy, 3/16" diameter x 1-14" long, 5/16" diameter head.
- C. "X" Braces: Two 18 gauge galvanized 3/4" steel straps with holes punched at each end. Rivet straps at centers. One "X" brace required every three (3) sections.
- D. Kickboard: Provide a 4" pine kickboard for each unit.
- E. Finish: Factory seal & lacquer (site finish is not acceptable)

**4.05 FABRICATION**

- A. Manufacture shelving in sizes as necessary to fit wall-to-wall as indicated on the drawings. Gaps in excess of 2" are not acceptable.
  - 1. Where dead corners are indicated on drawings, solid end panels will be required.
  - 2. Shelves shall not exceed 42" in length in general storage areas. Shelves with inset end supports and/or less than 3/4" thick must be pre-approved (sample required) and may not exceed 30" in length.

3. Modifications for shelves with inset end supports must be performed by the manufacturer. Field modifications will not be accepted.

## **PART 9.0 EXECUTION**

### **9.01 SURFACE CONDITIONS**

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

### **INSTALLATION**

- A. Install in strict accordance with manufacturer's current instructions and approved shop drawings.
- B. Anchor all wall units.

**END OF SECTION**

**SECTION 12 2400  
WINDOW SHADES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Interior manual roller shades.

**1.02 REFERENCE STANDARDS**

- A. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2023, with Errata.

**1.03 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
- B. Sequencing:
  - 1. Do not fabricate shades until field dimensions for each opening have been taken with field conditions in place.
  - 2. Do not install shades until final surface finishes and painting are complete.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
- C. Shop Drawings: Include shade schedule indicating size, location and keys to details, mounting dimension requirements for each product and condition, and operation direction.
- D. Selection Samples: Include fabric samples in full range of available colors and patterns.
- E. Verification Samples: Minimum size 6 inches square, representing actual materials, color and pattern.
- F. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- G. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of this type with minimum five years of documented experience with shading systems of similar size and type.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.
- B. Handle and store shades in accordance with manufacturer's recommendations.

**1.07 FIELD CONDITIONS**

- A. Do not install products under environmental conditions outside manufacturer's absolute limits.

**1.08 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Interior Manually Operated Roller Shades:
  - 1. Draper, Inc; Clutch Operated FlexShade: [www.draperinc.com/#sle](http://www.draperinc.com/#sle).



2. Hunter Douglas Architectural; RB500 Manual Roller Shades:  
[www.hunterdouglasarchitectural.com/#sle](http://www.hunterdouglasarchitectural.com/#sle).
  3. TimberBlindMetroShade; SolarVue Manual Roller Shade:  
[www.timberblinds.com/commercial-division/#sle](http://www.timberblinds.com/commercial-division/#sle).
  4. Substitutions: See Section 01 6000 - Product Requirements.
- B. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

## **2.02 ROLLER SHADES**

- A. General:
1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
  2. Provide shade system that operates smoothly when shades are raised or lowered.
- B. Roller Shades for Privacy:
1. Description - Interior Roller Shades: Single roller, manually operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.
    - a. Roll Direction: Roll down, closed position is at window sill.
    - b. Mounting: Window jamb mounted - inside, between jambs.
    - c. Size: As indicated on drawings.
    - d. Fabric: As indicated under Shade Fabric article.
  2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
  3. Roller Tubes: As required for type of shade operation.
  4. Hembars: Designed to maintain bottom of shade straight and flat.
  5. Manual Operation for Interior Shades:
    - a. Clutch Operator: Manufacturer's standard material and design, permanently lubricated.
    - b. Drive Chain: Continuous loop beaded ball chain, 95 lb minimum breaking strength. Provide upper and lower limit stops.
    - c. Chain Retainer:
      - 1) Manufacturer's standard clip.
  6. Accessories:
    - a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; clear anodized finish.
    - b. End Caps: Provide manufacturer's standard end caps to cover exposed ends of brackets.
    - c. Fasteners: Noncorrosive, and as recommended by shade manufacturer.

## **2.03 SHADE FABRIC**

- A. Fabric for Light-Filtering Shades: Nonflammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
1. Performance Requirements:
    - a. Flammability: Pass NFPA 701 large and small tests.
  2. Openness Factor: From 0 to 1 percent.
    - a. Privacy Shades: Soften the light yet still reveal some details to the outside; moderate privacy; Openness Factor approximately equal to 1 percent
    - b. Blackout Shades: Block virtually all the light; Openness Factor equal to zero percent.
  3. Color: As selected by Architect from manufacturer's full range of colors.

## **2.04 ROLLER SHADE FABRICATION**

- A. Field measure finished openings prior to ordering or fabrication.
- B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.
1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch space between bottom bar and window stool.

- 2. Horizontal Dimensions - Inside Mounting: Fill openings from jamb to jamb.
- C. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Examine finished openings for deficiencies that may preclude satisfactory installation.
- B. Start of installation shall be considered acceptance of substrates.

#### **3.02 PREPARATION**

- A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.
- B. Coordinate with window installation and placement of concealed blocking to support shades.

#### **3.03 INSTALLATION**

- A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.
- B. Replace shades that exceed specified dimensional tolerances at no extra cost to Owner.
- C. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

#### **3.04 CLEANING**

- A. Clean soiled shades and exposed components as recommended by manufacturer.
- B. Replace shades that cannot be cleaned to "like new" condition.

#### **3.05 CLOSEOUT ACTIVITIES**

- A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

#### **3.06 PROTECTION**

- A. Protect installed products from subsequent construction operations.
- B. Touch-up, repair, or replace damaged products before Substantial Completion.

#### **3.07 MAINTENANCE**

- A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

**END OF SECTION**

**SECTION 12 3600  
COUNTERTOPS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Countertops for architectural cabinet work.
- B. Wall-hung counters and vanity tops.

**1.02 RELATED REQUIREMENTS**

- A. Section 06 4100 - Architectural Wood Casework.

**1.03 REFERENCE STANDARDS**

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
- B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).
- C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.
- D. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.
- E. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- F. PS 1 - Structural Plywood; 2023.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.
- D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.
- E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

**1.05 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

**1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

**1.07 FIELD CONDITIONS**

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

**PART 2 PRODUCTS**

**2.01 COUNTERTOPS**

- A. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
  - 1. Flat Sheet Thickness: 1/2 inch, minimum.

2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
  - a. Manufacturers:
    - 1) Avonite Surfaces: [www.avonitesurfaces.com/#sle](http://www.avonitesurfaces.com/#sle).
    - 2) Dupont: [www.corian.com/#sle](http://www.corian.com/#sle).
    - 3) Formica Corporation: [www.formica.com/#sle](http://www.formica.com/#sle).
    - 4) Meganite, Inc: [www.meganite.com/#sle](http://www.meganite.com/#sle).
    - 5) Substitutions: See Section 01 6000 - Product Requirements.
  - b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
  - c. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
  - d. Color and Pattern: As selected by Architect from manufacturer's full line.
3. Other Components Thickness: 1/2 inch, minimum.
4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; square edge.
5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
6. Skirts: As indicated on drawings.
7. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Premium Grade.

## **2.02 MATERIALS**

- A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.
- B. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
- C. Joint Sealant: Mildew-resistant silicone sealant, clear.

## **2.03 FABRICATION**

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
  1. Join lengths of tops using best method recommended by manufacturer.
  2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
  3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
  1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
  2. Height: 4 inches, unless otherwise indicated.
- C. Solid Surfacing: Fabricate tops and wall panels up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

### **3.02 PREPARATION**

- A. Clean surfaces thoroughly prior to installation.

- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

**3.03 INSTALLATION**

- A. Install vanities in accordance with manufacturer's instructions and approved shop drawings
- B. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- C. Seal joint between back/end splashes and vertical surfaces.

**3.04 TOLERANCES**

- A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.
- B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.
- C. Field Joints: 1/8 inch wide, maximum.

**3.05 CLEANING**

**3.06 PROTECTION**

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

**END OF SECTION**

**SECTION 12 4813**  
**ENTRANCE FLOOR MATS AND FRAMES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Carpet mat.

**1.02 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating properties of walk-off surface, component dimensions.
- C. Shop Drawings: Indicate dimensions.
- D. Samples: Submit one samples, 4 by 4 inches in size illustrating pattern, color, finish, and edging.
- E. Maintenance Data: Include cleaning instructions, and stain removal procedures.

**PART 2 PRODUCTS**

**2.01 MANUFACTURERS**

- A. Floor Mats:
  - 1. Construction Specialties, Inc; Design Step: [www.c-sgroup.com/#sle](http://www.c-sgroup.com/#sle).
  - 2. R.C. Musson Rubber Co; Cobblestone Plus: [www.mussonrubber.com/#sle](http://www.mussonrubber.com/#sle).
  - 3. Pawling Corporation; EM-20: [www.pawling.com/#sle](http://www.pawling.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.

**2.02 MATS**

- A. Carptet Mat: Polypropylene needle puncher berber, permanently bonded to rubber backing, siae as indicated on drawings.
  - 1. Colors: To be selected by Architect from manufacturer's standard range.
  - 2. Surface-Mounted Frame: Aluminum, finish to be selected by Architect from manufacturer's full range.

**2.03 FABRICATION**

- A. Construct mat frames square, tight joints at corners, rigid.
- B. Fabricate mats in single unit sizes; fabricate multiple mats where indicated on drawings.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify that floor opening for mats are ready to receive work.

**3.02 PREPARATION**

- A. Mats: Verify size of floor recess before fabricating mats.
- B. Vacuum clean floor recess.

**3.03 INSTALLATION**

- A. Install walk-off surface smooth, and evenly adhered to slab after cleaning of finish flooring.

**END OF SECTION**

**SECTION 21 0100  
BASIC FIRE PROTECTION REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes the following:
  - 1. General Information Applying to all Division 21 Sections.
  - 2. Scope of Work.
  - 3. Substitution requests.
  - 4. Submittals.
  - 5. As-Built Drawings.
  - 6. Operating and maintenance manuals.
  - 7. Coordination.
  - 8. Cutting and patching.
  - 9. Access panels.
  - 10. General electrical work.

**1.3 GENERAL**

- A. Information specified in this section shall apply to all Division 21 specification sections.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to Division 21.
- C. Contractor shall provide coordination drawings per Division 01.
- D. Division 21 work shall be performed as outlined in "Information for Bidders".
- E. These specifications and the accompanying fire protection drawings are intended to provide for all labor, materials and equipment necessary for the installation of a complete
  - 1. Wet-pipe sprinkler system.
  - 2. Accessories including necessary apparatus, valves, and fittings hereinafter described or called for on the Contract Documents.
- F. All Division 21 work shall be installed in accordance with the following Codes and all Local Ordinances. Codes shall be latest editions approved by the NC Building Code Council with North Carolina amendments. Materials, equipment and workmanship shall be as specified throughout Division 21 specification sections.
  - 1. North Carolina State Building Code.
  - 2. North Carolina State Fire Prevention Code.
  - 3. National Electric Code.
  - 4. NFPA 13.
- G. All products used as part of the installation of the fire sprinkler system shall be Underwriter's Laboratories (UL) or Factory Mutual (F.M.) approved as required by NFPA 13.
- H. Contractor shall secure all required permits and inspection fees necessary for this work.
- I. The Sprinkler Contractor shall provide the Owner with a one-year warranty for all sprinkler system labor, equipment, and all other work specified in the Division 21 specifications and fire protection Contract Drawings, including the work of the Sprinkler Contractor's subcontractors. Warranty period shall begin upon Final Acceptance.

**1.4 SCOPE OF WORK**

- A. The Contractor shall be required to perform all the following work, in general and provide a complete fire sprinkler system(s) as shown on the plans. This Contractor's scope of work

begins at the sprinkler riser rough-in(s) provided by others, approximately one foot above the finished floor. The items in general are to be as follows:

1. Furnish and install complete wet-pipe sprinkler system as shown on the fire protection drawings and here-in specified.

#### **1.5 BIDDING PROCEDURE**

- A. The Contractor shall provide bidding for Alternate Bids in accordance with Division 01. Contractor shall refer to Division 01 for any required unit prices and allowances.

#### **1.6 SUBSTITUTION REQUESTS**

- A. The Sprinkler Contractor shall obtain written approval from the Engineer/Architect for the use of substitute materials claimed as equal to those specified. Substitution requests must be sent as soon after contract awards as possible and before any materials are ordered. Substitution requests are subject to deadlines posed by the Architect and/or Owner, as well as the requirements of Division 01.
- B. Applications approval of substitutions shall be made by the Sprinkler Contractor and not by subcontractors or manufacturer representative.
- C. Substitution requests shall be manufacturer's original published material.
- D. Once the allowable period for substitution requests has ended, no further substitutions will be permitted except in unusual or extenuating circumstances.

#### **1.7 SUBMITTALS**

- A. Submittals shall be sent to the Architect after the contract has been awarded and before any materials, fixtures, and equipment to be incorporated in the work has been ordered. Contractor is also required to submit shop drawings, hydraulic calculations, and materials submittal data as required below to the Authority Having Jurisdiction, including the NC Department of Insurance.
- B. Sprinkler system design submittal, including shop drawings, hydraulic calculations, and materials, shall be performed by a Professional Engineer registered in the State of North Carolina, or an individual who has Level III or IV certification from the National Institute for Certification in Engineering Technologies (NICET) in Fire Protection Engineering Technology: Water-Based Systems Layout in accordance with NICET 1014.
- C. Shop drawings, hydraulic calculations, and materials submittals shall be sent to our office for review at the same time, due to the influence each submittal has on the other two.
- D. Shop Drawings:
  1. The Sprinkler Contractor shall submit a set of installation plan drawings to the Architect before any materials, and equipment to be incorporated in the work has been ordered. **FAXED COPIES WILL NOT BE ACCEPTABLE.** Installation plan drawings shall include:
    - a. Hydraulic design data, including remote area designation(s), and locations of nodes.
    - b. Flow test data.
    - c. All piping, included mains, cross mains, branches, and armovers with sizes indicated.
    - d. Locations of couplings on grooved piping.
    - e. Location of Riser(s).
    - f. Riser Details.
    - g. Hanger Details.
    - h. U.L. Listed fire barrier penetration details.
    - i. Locations of sprinkler heads.
    - j. Sprinkler head legend, indicating the manufacturer, model number, temperature rating, and response characteristics of each type of sprinkler head.
    - k. Location of backflow preventer.
    - l. Location of fire department connection and associated check valve.
    - m. Location of backflow preventer test header.



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- n. Location of inspector's test connection(s).
  - o. Location of auxiliary drains.
  - p. Site diagram indicating water supply piping location, sizes, and hydraulic calculation nodes.
  - q. Preparer's NICET Certification ID or Professional Engineer Seal.
  - r. Coordination Drawings per Division 1.
- E. Hydraulic Calculations:
- 1. The Sprinkler Contractor shall submit a set of hydraulic calculations to the Architect before any materials, and equipment to be incorporated in the work has been ordered. Hydraulic Calculations shall be performed using computer-based software, such as HydraCALC or HASS. **FAXED COPIES WILL NOT BE ACCEPTABLE.** Hydraulic Calculations shall include:
    - a. Required water density and size of remote area(s), in accordance with NFPA and the Authority Having Jurisdiction.
    - b. Pressure and flow required for the system(s) to operate properly (after hose allowance has been added).
    - c. Flow test data.
    - d. Node by node analysis of required pressure, required flow, friction losses, and elevation.
    - e. Flow vs. pressure curves, indicating that sprinkler system curve(s) are sufficiently below flow test curve.
    - f. Safety Factor: Measured static and residual pressures shall be reduced by 10 psi each and measured flow shall be reduced by 10% when performing hydraulic calculations, per SCO requirements.
- F. Materials:
- 1. The Sprinkler Contractor shall submit a set of manufacturer's submittal data to the Architect before any materials, and equipment to be incorporated in the work has been ordered. **All sprinkler system components shall be UL listed and/or FM approved as required by NFPA 13.** Shop drawings shall include the name and address of the manufacturer and their catalog numbers and trade names clearly marked. All items shall be referenced to the specifications by **specification paragraph number on an index tab**. One complete set of submittal data shall be manufacturer's original published material. **FAXED COPIES WILL NOT BE ACCEPTABLE.** Approval of materials will be based upon the manufacturer's published ratings. Submit shop drawings and/or catalog data for the following material and equipment:
    - a. Sprinkler Heads.
    - b. Piping, Fittings, and Couplings.
    - c. Valves.
    - d. Gauges.
    - e. Hangers.
    - f. Riser Check Valve.
    - g. Flow Switch.
    - h. Fire Department Connection
    - i. Firestop Sealant.
    - j. Backflow Preventer. The backflow preventer is not in the Division 21 scope, but shall be included for the purposes of reviewing hydraulic calculation submittal.
    - k. Backflow Preventer Test Header.
  - 2. Submittals shall include the name and address of the manufacturer and their catalog numbers and trade names clearly marked.
  - 3. Submittal data shall be manufacturer's original published material.
- G. If data submitted deviates from the contract documents, the Sprinkler Contractor shall point out such deviations in writing and also state reasons for same.
- H. Review of materials will be based upon the manufacturer's published information.

- I. Once submittals are reviewed and no exceptions are taken, no changes in materials will be permitted except in unusual or extenuating circumstances.
- J. The Sprinkler Contractor shall review and stamp the submittals as being in accordance with his/her bid and the Contract Documents.
- K. Prior to submitting information, the Sprinkler Contractor shall field verify all necessary dimensions to ensure that all items will fit within designated rooms and/or spaces with proper clearances.
- L. Shop drawings and/or submittal review comments shall not relieve the Sprinkler Contractor of the responsibility to comply with the requirements and intent of the plans and specifications with regard to dimensions, capacities, quality, quantity, performance characteristics, etc.

#### 1.8 OPERATING AND MAINTENANCE MANUAL

- A. The Contractor shall deliver one complete set of bookmarked manuals in electronic PDF format to the Owner through the Designer, which shall include all operation and maintenance manuals, two (2) weeks before the pre-final inspection is held. The manuals shall be bookmarked to a minimum of one level – i.e.: each major piece of equipment (chiller, boiler switchboard, water closet, water heater, etc.) or document category (warranties, parts lists, contact information, etc.) The manuals shall be delivered by all of the following:
  - 1. USB Drive
  - 2. Hard Copy
- B. The manuals **shall** contain the following items as a minimum:
  - 1. Index and page numbers.
  - 2. Certificate of Final Acceptance.
  - 3. Summary sheet of warranties with dates noted.
  - 4. Sprinkler Contractor's one-year warranty.
  - 5. Sprinkler Contractor's contact information.
  - 6. All documented results of preliminary and system acceptance testing. This shall include the NFPA 13 Contractor's Materials and Test Certificate.
  - 7. All equipment startup reports.
  - 8. List of subcontractors and suppliers with names, addresses, and phone numbers.
  - 9. Complete set of all submittal data and current shop drawings (including third party generated shop drawings) and equipment description showing all capacities and other operation conditions. Submittal data shall include submittal sheets and hydraulic calculations. Shop drawings shall be the Sprinkler Contractor's final record shop drawings.
  - 10. Equipment summary showing all capacities and ratings (HP, Tons, kW, filter size, etc.)
  - 11. Manufacturer's warranty information for all components.
  - 12. Complete start-up, operation, and shutdown procedures for each system including sequence of events, locations of switches, emergency procedures, and any other critical items.
  - 13. Copy of NFPA 25, edition to match that which is currently enforced by the Authority Having Jurisdiction.
- C. **FAXED COPIES WILL NOT BE ACCEPTABLE.**

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

#### 1.10 COORDINATION

- A. Sprinkler Contractor shall be responsible to coordinate all work with the work of all other trades.
- B. The Contractor shall coordinate the exact location of incoming sprinkler riser rough-in with Division 33, and all other trades.

- C. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for sprinkler system installation.
- D. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- E. Coordinate requirements for access panels and doors for sprinkler system items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
  - 2. **MANUFACTURERS MODEL NUMBERS ARE PROVIDED FOR GENERAL INFORMATION ONLY.** Description of product shall take precedence over model numbers.

### **2.2 PIPE, TUBE, AND FITTINGS**

- A. Refer to individual Division 21 Sections for pipe, tube, and fitting materials and joining methods.

### **2.3 JOINING MATERIALS**

- A. Refer to individual Division 21 Sections for joining materials.

## **PART 3 - EXECUTION**

### **3.1 PIPING SYSTEMS - COMMON REQUIREMENTS**

- A. Install piping according to the following requirements and Division 21 Sections.
- B. The accompanying drawings are schematic only and are not intended to show all fittings, couplings, hangers, offsets, etc., unless specifically dimensioned. The layout shown on the drawings is a conceptual layout only. This contractor shall provide complete installation drawings for the sprinkler systems defined herein, per the Contract Drawings and these specifications. Provide all adjustments as necessary to conform to the structural conditions, machinery, equipment, work of other contractors and the intent of the drawings, without additional cost to the Owner. Fire protection consultant drawings should not be scaled. Secure dimensions from Architectural drawings. Refer to drawings of other trades and coordinate with other contractors. All equipment shall be installed in accordance with the manufacturer's published installation instructions and diagrams.
- C. All cutting and patching shall be in accordance with Division 01.
- D. Furnish and install all necessary sleeves, inserts, bolts, etc., for concrete floor slabs, roof, walls, and partitions. Failure to install such items in time to avoid delaying the project schedule shall result in the Sprinkler Contractor doing all cutting and repairing at his/her own expense.
- E. All equipment shall be installed in accordance with manufacturer's written installation instructions.
- F. All equipment shall be installed such that components do not provide a safety hazard to occupants who come within a close proximity.
- G. The Sprinkler Contractor shall provide access doors in accordance with Division 08 of these specifications. Access doors shall be provided for all valves located behind hard ceilings and in walls to provide access. Ceiling access doors shall be stainless steel and a minimum of 24" x 24". All access panels shall be labeled with a metal sign indicating what is behind the access panel. Sign shall have white background with red letters.
- H. The Sprinkler Contractor shall be responsible for all work damaged by him or her. Any fire sprinkler system work damaged by any other contractor shall be replaced by the Sprinkler Contractor and placed in perfect working condition without extra cost to the Owner. All sprinkler

heads, valves, pipe, fittings, and equipment shall be adequately protected before, during and after installation.

- I. The Contractor shall be responsible for all sprinkler heads, valves, pipe, fittings, and equipment at time of final inspection. Any broken items will be replaced by the Contractor at no cost to the owner regardless of by whom the item was broken.
- J. The Sprinkler Contractor, shall maintain a set of drawings marked up to show the work as installed. Contractor shall initial and date all changes to the approved shop drawings. The Architectural Observer may check this set of documents monthly for compliance. Upon completion of the work, Sprinkler Contractor shall use these as-built drawings to create a set of record drawings which shall be delivered to the Architect. A printed set of record drawings, along with hydraulic calculations updated as necessary due to field changes, shall be placed within a white PVC tube marked "Fire Sprinkler Shop Drawings" and securely fixed in the sprinkler riser room.

### **3.2 PIPING CONNECTIONS**

- A. Make connections according to the following, unless otherwise indicated:
  - 1. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

### **3.3 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS**

- A. Install equipment and piping to allow maximum possible headroom unless specific mounting heights are indicated.
- B. Install piping level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install sprinkler system components to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.

### **3.4 ELECTRICAL WIRING**

- A. Equipment connections to alarm and/or signaling systems, including but not limited to wiring of flow switches, pressure switches, and tamper switches, shall be provided by Fire Alarm Contractor. Wiring of Alarm Bell shall be by Fire Alarm Contractor.

### **3.5 PLACING IN SERVICE**

- A. Upon completion of the entire system installation, the entire system and all equipment shall be tested as described in individual Division 21 specification sections to ensure that it will function as intended.
- B. The Sprinkler Contractor shall furnish Owner's representative with Contractor's Material and Test Certificate, per NFPA.
- C. The Sprinkler Contractor shall place the entire system in a satisfactory operating condition and shall furnish all assistance and instructions required by the Owner's representative during initial operating period.

**END OF SECTION**

**SECTION 21 0517  
SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Sleeves.
  - 2. Grout.
  - 3. Sealants.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

**PART 2 - PRODUCTS**

**2.1 SLEEVES**

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, with plain ends.

**2.2 GROUT**

- A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

**2.3 SEALANTS**

- A. Watertight sealants as manufactured by Holdrite, Proset, Metacaulk, or 3M.

**2.4 FIRE/SMOKE BARRIER PENETRATION SYSTEMS**

- A. Provide U.L. listed systems by Metacaulk, 3M, or Hilti.

**PART 3 - EXECUTION**

**3.1 SLEEVE INSTALLATION**

- A. Install sleeves for piping passing through penetrations in **ALL** floors, partitions, roofs, and walls.
- B. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas **2 inches** above finished floor level.
  - 2. Using **grout**, seal space outside of sleeves in slabs and walls without sleeve-seal system.
- C. Install sleeves for pipes passing through interior partitions.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
  - 2. Seal with watertight sealant.
- D. Pipe sleeves shall be two pipe sizes larger than piping passing through the sleeve.
- E. Install sleeves concentric and centered on pipes.
- F. Ream all sleeves to prevent cutting of piping.
- G. Core drill openings for all floor openings may be utilized in lieu of sleeved openings. All openings shall be sized two pipe sizes larger than pipe passing thru the opening. All cored openings shall be fireproofed as required and shall be made water tight.

- H. All openings through floors shall be protected by watertight sealant.
- I. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: All penetrations in rated floors, firewalls and any other rated separations shall be protected using a through-penetration firestopping method with an "F" rating equivalent to the rating of the membrane being penetrated for particular piping materials used and membrane construction type. Floor penetrations shall additionally have a "T" rating equivalent to the rating of the floor being penetrated. Through-penetration firestop systems shall be installed and tested in accordance with ASTM E814 or UL 1479 with a minimum positive pressure differential 0.01 inch w.g. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping." All openings through horizontal fire separations shall be protected by U.L. listed systems.

### **3.2 SLEEVE AND SLEEVE-SEAL SCHEDULE**

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  - 1. Concrete Slabs above Grade:
    - a. Steel pipe sleeves.
  - 2. Interior Partitions:
    - a. Steel Pipe Sleeves.

**END OF SECTION**

**SECTION 21 0518  
ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Escutcheons.
  - 2. Floor plates.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

**PART 2 - PRODUCTS**

**2.1 ESCUTCHEONS**

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished, chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.
- D. Split-Casting, Brass Type: With polished, chrome-plated and rough-brass finish and with concealed hinge and setscrew.

**2.2 FLOOR PLATES**

- A. One-Piece Floor Plates: Cast iron flange with holes for fasteners.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons snug against room finish.
- C. Install escutcheons with ID to closely fit around pipe and with OD that completely covers opening.
  - 1. Escutcheons for New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
    - b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece cast brass or split-casting brass type with polished, chrome-plated finish.
    - c. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stamped steel type.
    - d. Bare Piping in Unfinished Service Spaces: One-piece cast brass or split-casting brass type with polished, rough-brass finish.
    - e. Bare Piping in Equipment Rooms: One-piece cast brass or split-casting brass type with polished, rough-brass finish.
- D. Install floor plates for piping penetrations of equipment-room floors.
- E. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
  - 1. New Piping: One-piece, floor plate.

**3.2 FIELD QUALITY CONTROL**

- A. Using new materials, replace broken and damaged escutcheons and floor plates.

**END OF SECTION**

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**SECTION 21 0553**  
**IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Valve labels.
  - 2. Riser Placards.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

**PART 2 - PRODUCTS**

**2.1 VALVE LABELS**

- A. Metal Labels for Control Valves, Zone Control Valves, Auxiliary Drain Valves, Inspectors Test Connections, and Main Drain:
  - 1. Letter Color: Red.
  - 2. Background Color: White.
  - 3. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
  - 4. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  - 5. Fasteners: Stainless-steel rivets or self-tapping screws, or chain.
  - 6. Adhesive: Permitted only on faces of access panels.
- B. Metal Riser Placard:
  - 1. Letter Color: White (information shall be filled in by Sprinkler Contractor with Black Letters).
  - 2. Background Color: Red.
  - 3. Fasteners: Stainless-steel rivets or self-tapping screws, or chain.
  - 4. Adhesive: Not permitted.
  - 5. Each placard shall contain the following data:
    - a. Location of area protected by riser.
    - b. Total number of sprinkler heads connected to riser.
    - c. Design density and design area, as approved.
    - d. Required flow rate and pressure at the base of the riser, as approved.

**PART 3 - EXECUTION**

**3.1 VALVES LABEL INSTALLATION**

- A. Install or permanently fasten labels on each control valve, zone control valve, main drain, auxiliary drains, and inspectors test connections.
- B. Locate labels where accessible and visible.
- C. Locate adhesive label on ceiling grid below valves or auxiliary drains located above ceilings, and on access panels concealing valves and auxiliary drains. Label shall describe the item (i.e. "AUXILIARY DRAIN"). Letter height shall be per ANSI.

**3.2 PLACARD INSTALLATION**

- A. Each individual riser shall be marked with a metal hydraulic placard.

**END OF SECTION**

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**SECTION 21 1313  
WET-PIPE SPRINKLER SYSTEMS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Pipes, fittings, and specialties.
  - 2. Specialty valves.
  - 3. Sprinklers.
  - 4. Alarm devices.
  - 5. Pressure gages.

**1.3 DEFINITIONS**

- A. High-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure higher than standard 175 psig, but not higher than **250 psig**.
- B. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

**1.4 ACTION SUBMITTALS**

- A. Sprinkler Contractor shall provide delegated design submittals, including materials, shop drawings, and hydraulic calculations, as indicated in Section 210100 "Basic Fire Protection Requirements."

**1.5 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

**1.6 MAINTENANCE MATERIAL SUBMITTALS**

- A. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench for each type of sprinkler used on Project.

**PART 2 - PRODUCTS**

**2.1 PERFORMANCE REQUIREMENTS**

- A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
  - 1. NFPA 13.
  - 2. All components shall be listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide." for the proposed application, as required by NFPA 13.
- B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- C. Delegated Design: Engage a qualified professional engineer, as defined in Section 210100 "Basic Fire Protection Requirements," to design wet-pipe sprinkler systems.
  - 1. See Contract Drawings for flow test data that was used for the preliminary design. Sprinkler Contractor is responsible for acquiring flow test data, less than one year old, from the local Fire Department, local Water Department, or by performing a flow test. Contractor shall coordinate with and get approval of date, time, and location of flow test from the local Fire Department and/or Water Department as required by local regulations.
  - 2. Sprinkler system design shall be approved by authorities having jurisdiction.
    - a. Sprinkler Occupancy Hazard Classifications: As indicated on Contract Drawings.
  - 3. Minimum Density for Automatic-Sprinkler Piping Design: Per NFPA 13 and as indicated on Contract Drawings.

4. Maximum Protection Area per Sprinkler: Per NFPA 13, Contract Drawings, and in accordance with listings of sprinkler heads.

## **2.2 STEEL PIPE AND FITTINGS**

- A. Schedule 40, Black Steel Pipe: ASTM A 795 and ANSI/ASTM A 53. Pipe ends may be factory or field formed to match joining method.
- B. Schedule 10, Black-Steel Pipe: ASTM A 795 and ANSI/ASTM A 53.
- C. Fittings for threaded black steel piping shall be cast iron threaded fittings.
- D. Fittings for grooved black steel piping shall be ductile iron grooved fittings conforming to ASTM A 536. Fittings shall be Victaulic "Firelock" joined with Victaulic "Firelock" rigid ductile iron couplings or approved equal by Grinnell or Reliable.
- E. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

## **2.3 HANGERS**

- A. Hangers for vertical piping shall be Riser Clamp design and shall be by Afcon, Viking, or Anvil.
- B. Hangers for horizontal piping shall be hanger rings attached to top beam clamps using 3/8" threaded rod. Provide Afcon, Viking, or Anvil.

## **2.4 SPECIALTY VALVES**

- A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- B. Pressure Rating:
  1. Standard-Pressure Piping Specialty Valves: 175-psig minimum, unless otherwise noted.
- C. Body Material: Cast or ductile iron.
- D. Size: Same as connected piping.
- E. End Connections: Flanged or grooved.
- F. Riser Check Valves:
  1. Reliable Model G, or approved equal by Tyco or Victaulic
  2. Design: For vertical installation.
  3. Features: Grooved connections, rated for 250 psi, with upstream and downstream pressure gauges, and main drain valve piped to exterior of the building.
- G. Control Valves shall be ductile iron butterfly valves.
  1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 112.
  2. Minimum Pressure Rating: 175 psig.
  3. Body Material: Ductile iron with nylon, EPDM, epoxy, or polyamide coating.
  4. Seat Material: EPDM.
  5. Stem: Stainless steel.
  6. Disc: Ductile iron.
  7. Actuator: Worm gear or traveling nut.
  8. Supervisory Switch: Internal or external.
  9. Body Design: Grooved-end connections.
- H. Valves not specified elsewhere in Division 21 shall be UL listed and/or FM approved as required by NFPA 13, and shall be listed specifically for fire protection service.

## **2.5 SPRINKLER PIPING SPECIALTIES**

- A. Flow Switch:
  1. Description: Electric vane-type water flow alarm switch. Activation shall be accomplished by the continuous flow of water against a non-corrosive paddle attached to a non-corrosive stem operating a field replaceable instantly recycling adjustable retard with a 0-90 second range and visual indication of activation. Expiration of the retard time shall result in the simultaneous operation of two sets of single pole double throw (SPDT) switch contacts rated at 10A, 125VAC and 2A, 30VDC. Each switch contact shall have a

separate wiring chamber and separate conduit entrance to comply with the separation of power limited and non-power limited conductors without the need for special wire or wire methods.

2. Potter (Viking) VSR or approved equal by System Sensor or Tyco.
  3. Pressure Rating: Up to 450 psi.
  4. Maximum Water Surge Listing: 18 fps.
  5. Alarm Activation Flow: 10 gpm maximum.
  6. Features: U bolt and saddle with non-corrosive insert for mounting to the pipe, a non-corrosive vane and trip stem assembly for detecting waterflow, and a retard time delayed switch to prevent false alarms from water surges. It shall be possible to install an optional cover tamper switch to detect removal of the enclosure.
  7. Enclosure: NEMA 4 rated, held captive by tamper resistant screws.
- B. Flexible Sprinkler Hose Fittings:
1. Standard: UL 1474.
  2. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
  3. Pressure Rating: 175-psig minimum.
  4. Size: As determined by Sprinkler Contractor's hydraulic calculations, using manufacturer's published data for equivalent length of black steel pipe. Minimum 1".

## 2.6 SPRINKLERS

- A. Sprinkler heads shall be listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide." for the proposed application.
- B. Sprinkler head types shall be as indicated on the Contract Drawings.
- C. All sprinkler heads shall be quick response type, unless otherwise indicated on the Contract Drawings.
- D. All sprinkler heads shall be glass bulb type.
- E. Sprinkler heads shall have ordinary temperature classification, unless otherwise indicated on the Contract Drawings, or required by NFPA 13.
- F. K-Factor of sprinkler heads shall be 5.6, 8.0, or 11.2.

## 2.7 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Electrically Operated Alarm Bell:
  1. System Sensor, Tyco, or Viking.
  2. Standard: UL 464.
  3. Type: Vibrating, metal alarm bell.
  4. Finish: Red-enamel factory finish, suitable for outdoor use.
  5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  6. Features: Under dome strikers and operating mechanisms, weatherproofed electrical box.
  7. Operating Voltage: 24VDC.
- C. Valve Supervisory Switches:
  1. Standard: UL 346.
  2. Type: Electrically supervised.
  3. Components: Single-pole, double-throw switch with normally closed contacts.
  4. Design: Signals that controlled valve is in other than fully open position.
  5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## **2.8 PRESSURE GAGES**

- A. Standard: UL 393.
- B. Dial Size: 3-1/2- to 4-1/2-inch diameter.
- C. Pressure Gage Range: 0- to 250-psig.

## **PART 3 - EXECUTION**

### **3.1 SERVICE-ENTRANCE PIPING**

- A. Install per Contract Drawings and Division 21 specifications.

### **3.2 PIPING INSTALLATION**

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of sprinkler main piping. Install piping as indicated on approved shop drawings.
  - 1. Deviations from approved shop drawings for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
  - 2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
- B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.
- C. All piping shall be NPS 1 or larger.
- D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- F. Install couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- G. Install Inspector's Test Connections in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- H. Piping shall be installed level, without slope, unless otherwise indicated on Contract Drawings.
  - 1. Exception: Piping installed immediately below sloped roofs shall match the slope of the roof.
- I. Install sprinkler piping with drains for complete system drainage.
  - 1. Exception: Trapped water in the amount of 5 gallons or less is acceptable per NFPA 13. The amount of trapped water in the system shall be minimized.
- J. Install all piping as directly as possible, avoiding unnecessary bends and turns so as not to interfere with proper installation of work of other Divisions.
- K. All piping shall be routed with a minimum clearance of ten (10) feet from any electrical panels, switchboards, panel boards, telephone backboards, or any other energized components.
- L. Piping shall be concealed in walls, or above ceilings, unless otherwise indicated on Contract Drawings.
  - 1. No sprinkler piping shall be covered or concealed until inspected by the Authority Having Jurisdiction.
- M. Piping shall not be installed underground.
- N. Install alarm devices in piping systems.
- O. Alarm bell shall be surface mounted on exterior of building.
- P. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
- Q. Support horizontal black steel pipe with hangers located every 12 feet for piping 1-1/4" or smaller and every 15 feet for all piping 1-1/2" or larger.

- R. Armovers longer than 24" shall be supported by hangers per NFPA 13.
- S. Top beam clamps shall only be attached to the top portion of structural members. All hangers shall permit adequate adjustment after erection while still supporting the load.
- T. Trapeze hangers are allowed only where it is necessary due to the required piping layout and structure.
- U. Trapeze hangers shall attach to the structure using top beam clamps located on both sides of trapeze hanger. Top beam clamps shall only be attached to the top portion of structural members.
- V. Hangers **SHALL NOT** be fastened to joist bridging or roof deck.
- W. Install pressure gages on riser or feed main, and at each sprinkler test connection. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they are not subject to freezing.
- X. Test header for backflow preventer shall be located outside of building, flush with exterior wall.
- Y. Fill sprinkler system piping with water.
- Z. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- AA. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- BB. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

### 3.3 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- D. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- F. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

### 3.4 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections.
- C. Specialty Valves:
  - 1. Install valves in vertical position for proper direction of flow, in main supply to system.

### **3.5 SPRINKLER INSTALLATION**

- A. Install sprinklers in suspended ceilings in center of ceiling tiles.
- B. Sprinkler heads shall be installed on armovers to allow their locations to be adjusted to the center of ceiling tiles.
- C. Sprinkler heads may be installed using flexible sprinkler hose fittings. Install hose into bracket on ceiling grid. Brackets shall not be visible from the floor.
- D. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

### **3.6 IDENTIFICATION**

- A. Install labeling on components according to requirements in NFPA 13 and as specified in Section 210553 "Identification for Fire-Suppression Piping and Equipment."
- B. Install hydraulic placard on each riser.

### **3.7 FIELD QUALITY CONTROL**

- A. All equipment and components located on site shall be protected from the weather and damage from construction equipment.
- B. The Contractor shall notify the Engineer forty-eight (48) hours in advance of all tests. The Contractor shall make all necessary preliminary tests to ensure a functional system, which shall include flushing, testing, and inspection of sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
- C. All tests shall be applied before any work is concealed or covered in any manner.
- D. All tests shall be conducted with regard to safety of all personnel on site.
- E. The Authority Having Jurisdiction shall be alerted to and invited to witness all Division 21 tests.
- F. Preliminary Tests:
  - 1. All sprinkler piping shall be made tight under a hydrostatic test pressure of 50 psi greater than the required design pressure, or 200 psi, whichever is greater. Hydrostatic test pressure shall be maintained without pressure loss for a minimum of two (2) hours. No caulking of joints will be permitted. Test pressure shall be read from a gauge located at the low elevation point of the system that is under test pressure. Any joint found to leak under this test shall be broken, remade and a new test applied.
  - 2. Waterflow detecting devices, including associated alarm circuits, shall be flow tested using the inspector's test connection. Alarm bell must be audible on premises within five (5) minutes of fully opening inspector's test connection. Each water-operated alarm device shall be tested to verify proper operation.
  - 3. Each tamper switch shall be tested by operating the associated valve.
  - 4. Following flushing of the underground piping, a main drain test shall be made to verify the adequacy of the water supply. Static and residual pressures shall be recorded and submitted. In addition, a main drain test shall be conducted each time after a main control valve is shut and opened.
  - 5. Energize circuits to electrical equipment and devices.
  - 6. Verify that equipment hose threads are same as local fire department equipment.
  - 7. Main drain valves shall be opened until the system pressure stabilizes.
  - 8. All control valves shall be fully opened and closed under system water pressure to ensure proper operation.
  - 9. All alarms, supervisory signals, and trouble signals that are related to the sprinkler system shall be activated and verified.
- G. A final acceptance test shall be conducted, only after all above tests have been successfully conducted and reports have been submitted and approved, in which a technician employed by the installing Sprinkler Contractor shall provide a complete demonstration of the operation of the system. This demonstration shall include operation of control valves and flowing of inspector's test connections to verify operation of associated waterflow alarm switches, as well as a



subsequent main drain test to verify that the control valves are in the open position. The technician shall have a copy of all "as-built" drawings, as well as certificates of previously conducted tests listed above. The sprinkler system installation shall not be considered accepted until as identified problems have been corrected, and the system is successfully retested. It is also required that the test documentation is properly completed and received prior to system acceptance.

- H. Prior to making a request of Beneficial Occupancy the Sprinkler Contractor shall submit written test reports and certificates as required by NFPA 13 and 24. Submittals shall include system acceptance forms copyrighted by NFPA which shall bear the NFPA copyright symbol. No other forms shall be considered.
- I. Sprinkler piping system will be considered defective if it does not pass tests and inspections. Replace damaged and malfunctioning controls and equipment, and retest as necessary.
- J. The Contractor shall furnish all necessary equipment, materials and labor to perform the above-specified tests. All equipment and materials shall be in excellent condition.
- K. Prepare test and inspection reports.

### **3.8 CLEANING**

- A. Clean dirt and debris from sprinklers.
- B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

### **3.9 DEMONSTRATION**

- A. Train Owner's maintenance personnel to adjust, operate, and maintain wet pipe sprinkler system.

### **3.10 PIPING SCHEDULE**

- A. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be the following:
  - 1. Schedule 40 black steel pipe with threaded ends, cast iron fittings, and threaded joints.
- B. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 and larger, shall be the following:
  - 1. Schedule 10 black steel pipe with roll-grooved ends, ductile iron fittings, and grooved joints.

### **3.11 SPRINKLER SCHEDULE**

- A. Per Contract Drawings.

**END OF SECTION**

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**SECTION 22 0100  
BASIC PLUMBING REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes the following:
  - 1. General Information Applying to all Division 22 Sections.
  - 2. Scope of Work.
  - 3. Substitution requests.
  - 4. Submittals.
  - 5. As-Built Drawings.
  - 6. Operating and maintenance manuals.
  - 7. Coordination.
  - 8. Cutting and patching.
  - 9. Access panels.
  - 10. General electrical work.
  - 11. Building Controls System interface.
  - 12. Connections to equipment provided by other divisions.

**1.3 GENERAL**

- A. Information specified in this section shall apply to all Division 22 specification sections.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to Division 22.
- C. Contractor shall provide coordination drawings for Division 01.
- D. Plumbing work shall be performed as outlined in "Information for Bidders".
- E. These specifications and the accompanying plumbing drawings are intended to provide for all labor, materials and equipment necessary for the installation of complete:
  - 1. Plumbing Fixtures.
  - 2. Equipment.
  - 3. Rough-Ins.
  - 4. Waste and Vent Systems.
  - 5. Condensate Drainage System.
  - 6. Domestic Cold Water System.
  - 7. Domestic Hot Water System.
  - 8. Fuel Gas System.
  - 9. Roof Drainage System.
  - 10. Accessories including necessary apparatus, valves, and fittings hereinafter described or called for on the Contract Documents.
- F. All Division 22 work shall be installed in accordance with the following Codes and all Local Ordinances. Materials, equipment and workmanship shall be as specified throughout Division 22 specification sections.
  - 1. North Carolina State Plumbing Code.
  - 2. North Carolina State Fire Prevention Code.
  - 3. National Electric Code.
  - 4. North Carolina State Fuel Gas Code.
  - 5. ICC A117.1 Accessible and Usable Buildings and Facilities.
  - 6. NSF Standard 61.
  - 7. NSF Standard 372.

## 22 0100 Basic Plumbing Requirements

- G. Contractor shall secure all required permits and inspection fees necessary for this work. Permits may be secured from the Building Inspections Department.
- H. The Contractor shall coordinate water and sewer taps and pay all fees in conjunction to provide services as required, for this project.
- I. The Plumbing Contractor shall provide the Owner with a one-year warranty for all plumbing labor, equipment, fixtures, and all other work specified in the Division 22 specifications and plumbing Contract Drawings, including the work of the Plumbing Contractor's subcontractors. Warranty period shall begin upon final acceptance by the Owner of the Plumbing Contractor's work.

### 1.4 SCOPE OF WORK

- A. The Contractor shall be required to perform all the following work, in general and provide a complete plumbing system as shown on the plans. The items in general are to be as follows:
  - 1. Furnish and install complete waste and vent system with connections to services as shown on the plumbing drawings and here-in specified.
  - 2. Furnish and install condensate drainage system as shown on the plumbing drawings and here-in specified.
  - 3. Furnish and install cold water system complete with connections to point as shown on the plumbing drawings and here-in specified.
  - 4. Furnish and install hot water system complete with connections to equipment as shown on the plumbing drawings and here-in specified.
  - 5. Furnish and install fuel gas piping system with connections to equipment as noted and/or as shown on the plumbing drawings and here-in specified.
  - 6. Furnish and install roof drainage leader system as shown on the plumbing drawings and here-in specified.
  - 7. Provide connections to equipment furnished and installed by other trades or Owner as shown on the plumbing drawings and here-in specified.

### 1.5 BIDDING PROCEDURE

- A. The Contractor shall provide bidding for Alternate Bids in accordance with Division 01. Contractor shall refer to Division 01 for any required unit prices and allowances.

### 1.6 SUBSTITUTION REQUESTS

- A. The Plumbing Contractor shall obtain written approval from the Engineer/Architect for the use of substitute materials claimed as equal to those specified. Substitution requests must be sent as soon after contract awards as possible and before any materials are ordered. Substitution requests are subject to deadlines posed by the Architect and/or Owner, as well as the requirements of Division 01.
- B. Applications approval of substitutions shall be made by the Plumbing Contractor and not by subcontractors or manufacturer representative.
- C. Substitution requests shall be manufacturer's original published material.
- D. Once the allowable period for substitution requests has ended, no further substitutions will be permitted except in unusual or extenuating circumstances.
- E. **Private labeled materials are not acceptable.**

### 1.7 SUBMITTALS

- A. Submittals shall be sent to the Architect after the contract has been awarded and before any materials, fixtures, and equipment to be incorporated in the work has been ordered.
- B. Submit shop drawings and/or catalog data for the material and equipment as indicated in individual Division 22 Sections.
- C. Submittals shall include the name and address of the manufacturer and their catalog numbers and trade names clearly marked.
- D. Submittal data shall be manufacturer's original published material.

- E. All items shall be referenced to the plans and specifications by **fixture designation or specification paragraph number**.
- F. If data submitted deviates from the contract documents, the Plumbing Contractor shall point out such deviations in writing and also state reasons for same.
- G. **FAXED COPIES WILL NOT BE ACCEPTABLE.**
- H. Review of materials will be based upon the manufacturer's published information.
- I. Contractor should note that all items shall be submitted by specification section.
- J. Once submittals are reviewed and no exceptions are taken, no changes in materials will be permitted except in unusual or extenuating circumstances.
- K. The Plumbing Contractor shall review and stamp the submittals as being in accordance with his/her bid and the Contract Documents.
- L. Shop drawings and/or submittal review comments shall not relieve the Plumbing Contractor of the responsibility to comply with the requirements and intent of the plans and specifications with regard to dimensions, capacities, quality, quantity, performance characteristics, etc.
- M. If the Contractor fails to submit any of the required materials, equipment, fixtures, etc., it shall be assumed that such items shall be installed as specified.

#### **1.8 OPERATING AND MAINTENANCE MANUAL**

- A. Operating and Maintenance Manuals shall be delivered in a format per Division 01. The manuals **shall** contain the following items as a minimum:
  - 1. Certificate of Final Acceptance.
  - 2. Plumbing Contractor's one-year warranty.
  - 3. Plumbing Contractor's contact information.
  - 4. Water Quality Test Report.
  - 5. Backflow Preventer Test Reports.
  - 6. All equipment startup reports.
  - 7. List of subcontractors and suppliers with names, addresses, and phone numbers
  - 8. Submittal sheets, manuals, and warranty information for **EVERY** item listed in the "Plumbing Fixture Schedule" on the Contract Drawings, as well as all equipment to be provided under Division 22.
  - 9. Information for all individual fixtures, pieces of equipment, etc. shall be individually tabbed, and a Table of Contents shall be provided.
- B. **FAXED COPIES WILL NOT BE ACCEPTABLE.**

#### **1.9 QUALITY ASSURANCE**

- A. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

#### **1.10 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

#### **1.11 COORDINATION**

- A. Plumbing Contractor shall be responsible to coordinate all work with the work of all other trades.
- B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.
- C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

- D. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
  - 2. **MANUFACTURERS MODEL NUMBERS ARE PROVIDED FOR GENERAL INFORMATION ONLY.** Description of product shall take precedence over model numbers.

### **2.2 PIPE, TUBE, AND FITTINGS**

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

### **2.3 JOINING MATERIALS**

- A. Refer to individual Division 22 piping Sections for joining materials.

### **2.4 FIXTURES**

- A. All exposed piping and metal parts shall be chrome plated. Slip joints will not be permitted except on fixture side of trap. Rigid supplies are specified for fixtures and it is intended that they be installed true and plumb from fixture to wall rough in. Connections for water closets shall be made by use of metal reinforced flanges compatible to waste piping materials and verminproofed wax gaskets.
- B. All floor-mounted water closets shall be set and grouted with white grout between floor and closet base.
- C. All wall-hung fixtures shall be sealed between wall and fixture with clear "G.E. Silicone Seal" caulking.
- D. All counter mounted fixture rims shall be sealed with clear "G.E. Silicone Seal" caulking.

### **2.5 ELECTRICAL COMPONENTS**

- A. Motors shall comply with Section 220513 "Common Motor Requirements for Plumbing Equipment."

## **PART 3 - EXECUTION**

### **3.1 PIPING SYSTEMS - COMMON REQUIREMENTS**

- A. Install piping according to the following requirements and Division 22 Sections.
- B. The Contract Drawings are schematic only and are not intended to show all fittings, bolts, connections, offsets, etc., unless specifically dimensioned. Follow drawings as closely as possible, provide all adjustments as necessary to conform to the structural conditions, machinery, equipment, work of other contractors and the intent of the drawings, without additional cost to the Owner. Plumbing drawings should not be scaled. Secure dimensions and exact locations of plumbing fixtures and other items from Architectural drawings. Refer to drawings of other trades and coordinate with other contractors. All items of equipment shall be installed in accordance with the manufacturer's published installation instructions and diagrams.
- C. All cutting and patching shall be in accordance with Division 01.
- D. All excavation, trenching and backfilling shall be in accordance with Division 31.
- E. Furnish and install all necessary sleeves, inserts, bolts, etc., for concrete floor slabs, roof, walls, and partitions. Failure to install such items in time to avoid delaying the project schedule shall result in the Plumbing Contractor doing all cutting and repairing at his/her own expense.
- F. Verify final equipment locations for roughing-in.

- G. All equipment shall be installed in accordance with manufacturer's written installation instructions.
- H. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
- I. The Plumbing Contractor shall provide access doors in accordance with Division 08. Access doors shall be provided for all valves and shock arrestors located behind hard ceilings and in walls to provide access. Ceiling access doors shall be stainless steel and a minimum of 24" x 24".
- J. The Plumbing Contractor shall be responsible for all work damaged by him/her. Any plumbing work damaged by any other contractor shall be replaced by the Plumbing Contractor and placed in perfect working condition without extra cost to the Owner. All fixtures and fittings shall be adequately protected before, during and after installation.
- K. The Contractor shall be responsible for all plumbing fixtures at time of final inspection. Any broken fixtures will be replaced by the Contractor at no cost to the owner regardless of by whom the fixture was broken.
- L. The Contractor shall notify the Engineer a minimum of forty-eight (48) hours in advance of all tests. The Contractor shall make all necessary preliminary tests to insure a tight system. Any joint found to leak under test shall be broken, cleaned and remade.
- M. The Plumbing Contractor, shall maintain "during the course of the work" a set of drawings marked up to show the work as installed, including dimensions to and elevations of buried work. Contractor shall initial and date all changes to the contract drawings. The Architectural Observer may check this set of documents monthly for compliance. Upon completion of the work, return this set of drawings to the Architect.

### **3.2 PIPING CONNECTIONS**

- A. Make connections according to the following, unless otherwise indicated:
  - 1. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
  - 2. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

### **3.3 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS**

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

### **3.4 ELECTRICAL WIRING**

- A. The Electrical Contractor shall furnish all disconnects and motor starters and wire and make all final electrical connections to equipment provided under Division 22. See Electrical Drawings.
  - 1. EXCEPTION: Plumbing Contractor shall provide Aquastat(s) as indicated on Contract Drawings and in "CONTROLS" section of Specification Section 220100 "Basic Plumbing Requirements". The Plumbing Contractor shall be responsible for Aquastat wiring connections

### **3.5 CONTROLS**

- A. The DDC shall control power to the Water Heaters. Water heater temperature settings shall be controlled manually with integral adjustable thermostat.

- B. The DDC shall control power to the circulator pumps, in order to power them during Owner-selected occupied hours. Circulator Pumps shall be controlled by specified Aquastats during such occupied hours.
- C. The DDC shall monitor the hot water temperature in the water heater via a temperature sensor. Temperature sensor shall be installed on water heater lower temperature probe and notify DDC when temperature drop above or below temperature set points. Low temperature alarm shall be set to 130 degrees. High temperature alarm shall be set to 145 degrees.

**3.6 PLACING IN SERVICE**

- A. Upon completion of the entire system installation, the entire system and all equipment shall be tested by actual operation to provide that it will function as intended.
- B. The Plumbing Contractor shall place the entire system in a satisfactory operating condition and shall furnish all assistance and instructions required by the Owner's representative during initial operating period. The Contractor shall acquaint the Owner's representative with the special parts required for the operation plumbing fixtures and equipment furnished and installed on the project.
- C. It is the Contractor's responsibility to turn over to the owner all fixtures and floor drains in a clean condition.

**END OF SECTION**



**SECTION 22 0513  
COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory.

**1.3 COORDINATION**

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
  - 1. Motor controllers.
  - 2. Torque, speed, and horsepower requirements of the load.
  - 3. Ratings and characteristics of supply circuit and required control sequence.
  - 4. Ambient and environmental conditions of installation location.

**PART 2 - PRODUCTS**

**2.1 GENERAL MOTOR REQUIREMENTS**

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. Comply with IEEE 841 for severe-duty motors.

**2.2 MOTOR CHARACTERISTICS**

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

**2.3 SINGLE-PHASE MOTORS**

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
  - 1. Permanent-split capacitor.
  - 2. Split phase.
  - 3. Capacitor start, inductor run.
  - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

**PART 3 - EXECUTION (Not Applicable)**

**END OF SECTION**

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**SECTION 22 0516  
EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Pipe loops and swing connections.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

**1.4 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For expansion joints to include in maintenance manuals.

**1.5 QUALITY ASSURANCE**

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe and Pressure-Vessel Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

**PART 2 - PRODUCTS**

**2.1 PERFORMANCE REQUIREMENTS**

- A. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.
- B. Capability: Products to absorb 200 percent of maximum axial movement between anchors.

**2.2 PACKLESS EXPANSION JOINTS**

- A. Flexible-Hose Packless Expansion Joints:
  - 1. Metraflex Metraloop or approved equal by Flex-Hose Co., or Mason Industries.
  - 2. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose.
  - 3. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.
  - 4. Expansion Joints for Copper Tubing NPS 2 and Smaller: Copper-alloy fittings with solder-joint end connections.
    - a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F and 225 psig at 450 deg F ratings
  - 5. Expansion Joints for Copper Tubing NPS 2-1/2 to NPS 4: Copper-alloy fittings with threaded end connections.
    - a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F and 225 psig at 450 deg F ratings.

**PART 3 - EXECUTION**

**3.1 PIPE LOOP AND SWING CONNECTION INSTALLATION**

- A. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.
- B. Space no more than 100 ft. on center.

**END OF SECTION**

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**SECTION 22 0517  
SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Sleeves.
  - 2. Grout.
  - 3. Sealants.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. For penetrations in fire and smoke rated partitions, provide UL Detail for fire stop system.

**PART 2 - PRODUCTS**

**2.1 SLEEVES**

- A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe.
- B. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, with plain ends.
- C. PVC pipe sleeves are not acceptable.

**2.2 FIRE/SMOKE BARRIER PENETRATION SYSTEMS**

- A. Provide U.L. listed systems by Metacaulk, 3M, or Hilti.

**2.3 SEALANTS**

- A. Watertight sealants as manufactured by Holdrite, Proset, Metacaulk, or 3M.

**2.4 GROUT**

- A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

**PART 3 - EXECUTION**

**3.1 SLEEVE INSTALLATION**

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2" inches above finished floor level.
    - b. Exception: Extend sleeves on piping passing through foundation walls 6" beyond wall footing on both sides.
    - c. Exception: Extend sleeves on piping installed below structural footings as indicated on contract drawings.
  - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- C. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
- D. Pipe sleeves shall be two pipe sizes larger than piping passing through the sleeve.
- E. Sleeves for insulated piping shall be large enough to allow the insulation to pass thru sleeve unbroken.
- F. Install sleeves concentric and centered on pipes.
- G. Ream all sleeves to prevent cutting of piping.
- H. Core drill openings for all floor openings may be utilized in lieu of sleeved openings. All openings shall be sized two pipe sizes larger than pipe passing thru the opening. All cored openings shall be fireproofed as required and shall be made water tight.
- I. All openings through floors shall be protected by watertight sealant.
- J. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: All penetrations in rated floors, firewalls and any other rated separations shall be protected using a through-penetration firestopping method with an "F" rating equivalent to the rating of the membrane being penetrated for particular piping materials used and membrane construction type. Floor penetrations shall additionally have a "T" rating equivalent to the rating of the floor being penetrated. Through-penetration firestop systems shall be installed and tested in accordance with ASTM E814 or UL 1479 with a minimum positive pressure differential 0.01 inch w.g. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping." All openings through horizontal fire separations shall be protected by U.L. listed systems.

### **3.2 SLEEVE AND SLEEVE-SEAL SCHEDULE**

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  1. Exterior Concrete Walls above Grade:
    - a. Piping Smaller Than NPS 10: Cast-Iron pipe sleeves.
  2. Exterior Concrete Walls below Grade:
    - a. Piping Smaller Than NPS 10: Cast-iron pipe sleeves.
  3. Concrete Slabs above Grade:
    - a. Piping Smaller Than NPS 10: Steel pipe sleeves.
  4. Interior Partitions:
    - a. Piping Smaller Than NPS 10: Steel pipe sleeves.

### **END OF SECTION**

**SECTION 22 0518  
ESCUTCHEONS FOR PLUMBING PIPING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Escutcheons.
  - 2. Floor plates.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

**PART 2 - PRODUCTS**

**2.1 ESCUTCHEONS**

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough brass finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished, chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.
- D. Split-Casting, Brass Type: With polished, chrome-plated and rough-brass finish and with concealed hinge and setscrew.
- E. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed and exposed-rivet hinge; and spring-clip fasteners.

**2.2 FLOOR PLATES**

- A. Split Floor Plates: Cast brass with concealed hinge.
- B. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons snug against room finish.
- C. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
  - 1. Escutcheons for New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
    - b. Chrome-Plated Piping: One-piece cast brass or split-casting brass with polished, chrome-plated finish.
    - c. Insulated Piping: One-piece stamped steel type or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece cast brass or split-casting brass type with polished, chrome-plated finish.
    - e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece cast brass or split-casting brass type with polished, chrome-plated finish.
    - f. Bare Piping in Unfinished Service Spaces: One-piece cast brass or split-casting brass type with polished, chrome-plated finish.
    - g. Bare Piping in Equipment Rooms: One-piece cast brass or split-casting brass type with rough-brass finish.
- D. Install floor plates for piping penetrations of equipment-room floors.

- E. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
  - 1. New Piping: One-piece, floor plate.

**3.2 FIELD QUALITY CONTROL**

- A. Using new materials, replace broken and damaged escutcheons and floor plates.

**END OF SECTION**



**SECTION 22 0519  
METERS AND GAGES FOR PLUMBING PIPING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Bimetallic-actuated thermometers.
  - 2. Thermowells.
  - 3. Dial-type pressure gages.
  - 4. Gage attachments.
  - 5. Test plugs.
  - 6. Test-plug kits.
  - 7. Water meters.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

**1.4 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

**PART 2 - PRODUCTS**

**2.1 BIMETALLIC-ACTUATED THERMOMETERS**

- A. Weiss Model 3VBM Series, or approved equal by Omega or Tel-Tru Mfg. Co.
- B. Standard: ASME B40.200.
- C. Case: Type 304 Stainless steel, 3-inch nominal diameter.
- D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F. Thermometers' range shall be such that the operating temperature shall be in the middle portion of the dial.
- E. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.
- F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.
- G. Stem: Stainless steel.
- H. Window: Plain glass.
- I. Ring: Stainless steel.
- J. Element: Bimetal coil.
- K. Pointer: Dark-colored metal.
- L. Accuracy: Plus or minus 1 percent of scale range.
- M. Compliance: NSF Standard 61 & 372

**2.2 THERMOWELLS**

- A. Thermowells:
  - 1. Standard: ASME B40.200.
  - 2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
  - 3. Material for Use with Copper Tubing: CNR or CUNI.
  - 4. Material for Use with Steel Piping: CRES or CSA.
  - 5. Type: Stepped shank unless straight or tapered shank is indicated.
  - 6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.

7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

C. Compliance: NSF Standard 61 & 372

### **2.3 PRESSURE GAGES**

- A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
1. Weiss Model 3PG1, or approved equal by Omega or Tel-Tru Mfg. Co.
  2. Standard: ASME B40.100.
  3. Case: Cast aluminum or drawn steel; 3-1/2-inch nominal diameter.
  4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
  5. Pressure Connection: Brass, with NPS 1/4, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
  6. Movement: Mechanical, with link to pressure element and connection to pointer.
  7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi. Range shall be such that the operating temperature shall be in the middle portion of the dial.
  8. Pointer: Dark-colored metal.
  9. Window: Glass.
  10. Ring: Metal.
  11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

### **2.4 GAGE ATTACHMENTS**

- A. Snubbers: ASME B40.100, brass; with NPS 1/4, ASME B1.20.1 pipe threads and piston or porous-metal-type surge-dampening device. Include extension for use on insulated piping.
- B. Valves: Brass ball or brass or stainless-steel needle, with NPS 1/4, ASME B1.20.1 pipe threads.
- C. Compliance: NSF Standard 61 & 372

### **2.5 TEST PLUGS**

- A. Description: Test-station fitting made for insertion into piping tee fitting.
- B. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
- C. Thread Size: NPS 1/4, ASME B1.20.1 pipe thread.
- D. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.
- E. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.
- F. Compliance: NSF Standard 61 & 372

### **2.6 TEST-PLUG KITS**

- A. Furnish one Insert number test-plug kit(s) containing two thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.
- B. Low-Range Thermometer: Small, bimetallic insertion type with 1 to 2-inch diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F.
- C. High-Range Thermometer: Small, bimetallic insertion type with 1 to 2-inch diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.
- D. Pressure Gage: Small, Bourdon-tube insertion type with 2 to 3-inch diameter dial and probe. Dial range shall be at least 0 to 200 psig.

- E. Carrying Case: Metal or plastic, with formed instrument padding.

## **2.7 WATER METERS**

- A. Turbine-Type Water Meters:
  - 1. Onicon F-1220 or approved equal.
  - 2. Standard: AWWA C701.
  - 3. Body Design: Dual Turbine; totalization meter.
  - 4. Features: 316 stainless steel wetted ports.
- B. Remote Registration System: Meter shall provide a binary (digital) dry contact output signal corresponding to flow rate, which is divided to meet the monitoring system input frequency limitation. Meter shall be connected to BAS.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install thermowells with socket extending a minimum of 2 inches into fluid and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.
- G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- H. Install valve and snubber in piping for each pressure gage for fluids.
- I. Install test plugs in piping tees.
- J. Install thermometers in the following locations:
  - 1. Inlet and outlet of each water heater.
  - 2. Inlet and outlet of each domestic hot-water storage tank.
  - 3. Inlet and outlet of each master mixing valve.
  - 4. Locations indicated on Contract Drawings.
- K. Install pressure gages in the following locations:
  - 1. Building water service entrance into building.
  - 2. Suction and discharge of each domestic water pump.
  - 3. Locations indicated on Contract Drawings.

### **3.2 CONNECTIONS**

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

### **3.3 ADJUSTING**

- A. Adjust faces of meters and gages to proper angle for best visibility.

### **3.4 THERMOMETER SCALE-RANGE SCHEDULE**

- A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F.
- B. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F.

### **3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE**

- A. Scale Range for Domestic Water Piping: 0 to 200 psi.

### **END OF SECTION**

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**SECTION 22 0523**  
**GENERAL-DUTY VALVES FOR PLUMBING PIPING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Bronze ball valves.
  - 2. Iron ball valves.
  - 3. Bronze swing check valves.
  - 4. Iron swing check valves.
  - 5. Iron, single-flange butterfly valves.
  - 6. Valve boxes.

**1.3 DEFINITIONS**

- A. CWP: Cold working pressure.

**1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of valve.
  - 1. Certification that products comply with NSF 61 and NSF 372.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, and soldered ends.
  - 3. Set ball valves open to minimize exposure of functional surfaces.
  - 4. Set check valves in either closed or open position.
  - 5. Set butterfly valves closed or slightly open.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

**PART 2 - PRODUCTS**

**2.1 GENERAL REQUIREMENTS FOR VALVES**

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
  - 1. ASME B1.20.1 for threads for threaded end valves.
  - 2. ASME B16.1 for flanges on iron valves.
  - 3. ASME B16.18 for solder-joint connections.
- C. NSF Compliance: NSF 61 and NSF 372 for valve materials for potable-water service.
- D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as connected piping unless otherwise indicated.

- G. Valve Actuator Types:
  - 1. Gear Actuator: For quarter-turn valves NPS 4 and larger.
  - 2. Handlever: For quarter-turn valves smaller than NPS 4.
  - 3. Butterfly valves: Lock handle with memory stop.
- H. Valves in Insulated Piping:
  - 1. Include stem extensions for insulation thicknesses specified.
  - 2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.

## **2.2 BRONZE BALL VALVES**

- A. Bronze Ball Valves, Two-Piece with Bronze Trim:
  - 1. Description:
    - a. CWP Rating: 200 psig.
    - b. Body Design: One piece.
    - c. Body Material: Bronze.
    - d. Ends: Threaded or soldered.
    - e. Ball: Chrome-plated brass.
    - f. Port: Full.

## **2.3 IRON BALL VALVES**

- A. Iron Ball Valves, Class 200 WOG:
  - 1. Description:
    - a. CWP Rating: 200 psig.
    - b. Body Design: Split body.
    - c. Body Material: ASTM A 126, gray iron.
    - d. Ends: Flanged .
    - e. Ball: Stainless steel.
    - f. Port: Full.

## **2.4 BRONZE SWING CHECK VALVES**

- A. Bronze Swing Check Valves, Class 125:
  - 1. Description:
    - a. CWP Rating: 125 psig.
    - b. Body Design: Horizontal flow.
    - c. Ends: Threaded.

## **2.5 IRON SWING CHECK VALVES**

- A. Iron Swing Check Valves with Metal Seats, Class 125:
  - 1. Description:
    - a. CWP Rating: 120 psig.
    - b. Body Material: Cast iron with bolted bonnet.
    - c. Ends: Flanged.
    - d. Gasket: Asbestos free.

## **2.6 IRON, SINGLE-FLANGE BUTTERFLY VALVES**

- A. Iron, Single-Flange Butterfly Valves with Aluminum-Bronze Disc:
  - 1. Description:
    - a. Standard: MSS SP-67, Type I.
    - b. Body Design: Lug type.
    - c. Body Material: ASTM A 536, ductile iron.
    - d. Seat: EPDM, rated at 250°F.
    - e. Stem: One- or two-piece stainless steel.
    - f. Disc: Aluminum bronze.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

#### **3.2 VALVE INSTALLATION**

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Check Valves: Install check valves for proper direction of flow.
  - 1. Swing Check Valves: In horizontal position with hinge pin level.
- F. Install valve tags. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

#### **3.3 ADJUSTING**

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

#### **3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS**

- A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
- B. Select valves types with the end connections as specified in as specified in Section 221116 "Domestic Water Piping."

**END OF SECTION**

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**SECTION 22 0529**  
**HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Metal pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Fiberglass pipe hangers.
  - 4. Metal framing systems.
  - 5. Fiberglass strut systems.
  - 6. Thermal hanger-shield inserts.
  - 7. Fastener systems.
  - 8. Pipe stands.
  - 9. Pipe-positioning systems.
  - 10. Equipment supports.
- B. Related Requirements:
  - 1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
  - 2. Section 220516 "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

**1.4 QUALITY ASSURANCE**

- A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.
- B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

**PART 2 - PRODUCTS**

**2.1 METAL PIPE HANGERS AND SUPPORTS**

- A. Carbon-Steel Pipe Hangers and Supports:
  - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  - 2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
  - 3. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
  - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel or stainless steel.
  - 6. Vertical Piping: Riser Clamp design and shall be Modern Fig. 500, Grinnell/Anvil Fig. 261, or approved equal by Elite Components.
  - 7. Horizontal Piping: Clevis type and shall be Modern Fig. 590, Grinnell/Anvil Fig. 260 or approved equal by Elite Components.
- B. Stainless-Steel Pipe Hangers and Supports:
  - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  - 2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  - 3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

4. Vertical Piping: Riser Clamp design, stainless steel, and shall be Anvil Fig. 261SS, Eaton B-Line B3373, or Empire Industries Fig. 50.
5. Horizontal Piping: Clevis type, stainless steel and shall be Anvil Fig. 260SS, Eaton B-Line B3100, or Empire Industries.

## **2.2 TRAPEZE PIPE HANGERS**

- A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

## **2.3 INSULATION PROTECTION SADDLES**

- A. Material: 16 gauge galvanized steel.
- B. Length: 12", centered on each hanger.
- C. Insulation Shields shall cover lower 180 degrees of pipe in the case of clevis hangers, and entire circumference of pipe in the case of trapeze hangers or clamps.

## **2.4 EQUIPMENT SUPPORTS**

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-carbon-steel shapes.

## **2.5 MATERIALS**

- A. Aluminum: ASTM B 221.
- B. Carbon Steel: ASTM A 1011/A 1011M.
- C. Structural Steel: ASTM A 36/A 36M carbon-steel plates, shapes, and bars; black and galvanized.
- D. Stainless Steel: ASTM A 240/A 240M.
- E. Grout: ASTM C 1107/C 1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  1. Properties: Nonstaining, noncorrosive, and nongaseous.
  2. Design Mix: 5000-psi, 28-day compressive strength.

# **PART 3 - EXECUTION**

## **3.1 HANGER AND SUPPORT INSTALLATION**

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
  1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
  2. Field fabricate from ASTM A 36/A 36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- D. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- E. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- F. Install building attachments to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping.

- G. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- H. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- I. Hangers for insulated piping shall extend around the insulation.
- J. Provide Insulation Protection Saddles on all insulated piping.
- K. Hangers shall be spaced per the NC State Plumbing Code in accordance with the piping material.
- L. A hanger shall be provided within one (1) foot of each bend in horizontal piping. Vertical piping shall be supported at each floor or at intervals not exceeding ten (10) feet. Support cast iron soil pipe to each joint.
- M. For piping 4" in diameter and larger, rigid support sway bracing shall be provided at changes in direction greater than 45 degrees.
- N. Hangers shall be fastened by means of threaded rods to steel beam clamps, center of bar joist, center of trusses, etc. All hangers shall permit adequate adjustment after erection while still supporting the load. All hanger rods attached to bar joist and trusses shall be install between bottom or top cords of the structural member. Structural members to span from building structure to structure shall be provided by the Contractor.
- O. Hangers shall only be hung with drilling into the slab with "drop-in" hangers with the approval of the Structural Engineer of record and the Mechanical Engineer of record with complete dead and operating load information provided for each location. Loading information shall be provided by the Plumbing Contractor.
- P. Hangers SHALL NOT be fastened to joist bridging or roof deck.
- Q. Piping supported on a trapeze hanger shall be secured to the trapeze hanger by means of a pipe clamp around the pipe insulation and insulation saddle. Bare piping shall be secured by a pipe clamp and isolated by an isolation cushion.

### **3.2 METAL FABRICATIONS**

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

### **3.3 ADJUSTING**

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

### **3.4 HANGER AND SUPPORT SCHEDULE**

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment. Hanger and support requirements in this Section apply to all piping systems.
- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.

- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of uninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
- F. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
- G. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

**END OF SECTION**

**SECTION 22 0553**  
**IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Equipment labels.
  - 2. Pipe labels.
  - 3. Valve tags.
  - 4. Warning tags.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- C. Valve Schedules: For each piping system to include in maintenance manuals.

**PART 2 - PRODUCTS**

**2.1 EQUIPMENT LABELS**

- A. Plastic Labels for Equipment:
  - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
  - 2. Letter Color: Black.
  - 3. Background Color: White.
  - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
  - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
  - 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
  - 7. Fasteners: Stainless-steel self-tapping screws.
- B. Label Content: Include equipment's unique equipment number, capacity, final date of acceptance for equipment item and warranty information.
- C. Signage shall be provided for the following items:
  - 1. Water Heaters
  - 2. Circulator Pumps
  - 3. Water Meter

**2.2 PIPE LABELS**

- A. Custom MS-790 as manufactured by Marketing Service Incorporated or approved equal Steton, Emed or DuraLabel.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to **cover full** circumference of pipe and to attach to pipe without fasteners or adhesive.
- D. Pipe identification markers shall comply with ANSI A13.1.

- E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: Per ANSI.
  - 3. Colors: Per ANSI.
  - 4. Wording on markers shall be as follows where more stringent than ANSI Standards:
    - a. Cold Water
    - b. Hot Water
    - c. Hot Water Return
    - d. Waste
    - e. Vent
    - f. Condensate
    - g. Roof Drain
    - h. Fuel Gas (With pressure noted)

### **2.3 VALVE TAGS**

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
  - 1. Tag Material: Brass, 19 gauge, and having predrilled or stamped holes for attachment hardware.
  - 2. Fasteners: Brass wire-link chain, beaded chain, or S-hook.
- B. Valve Schedules: Provide a valve chart listing all valves with size and service framed and mounted under glass in the main mechanical room .
  - 1. Valve-tag schedule shall be included in operation and maintenance data.
- C. Valve Ceiling Labels: Provide a self-sticking 1/2" diameter dot on lay-in ceiling grid at all valve locations. Red dot for domestic hot water supply and return, Blue for cold water.

### **2.4 PAINTING**

- A. The Contractor should note that plumbing piping may be exposed in various areas. The contractor should specifically note that all exposed cast iron piping be uncoated.
- B. All exposed plumbing pipe and plumbing pipe insulation in areas other than mechanical rooms shall be left clean and free from oil ready for painting by the Painter. All finished painting will be by the Painter with colors to match the surrounding areas.
- C. All exposed gas piping exposed to the exterior and exposed in mechanical rooms shall be cleaned of all rust and painted with one (1) coat of rust inhibitor primer and two (2) coats of oil base Yellow paint. Sherwin Williams #SW6911 Pantone #102C.
- D. All plumbing equipment pads shall be painted yellow.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

### **3.2 GENERAL INSTALLATION REQUIREMENTS**

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

### **3.3 EQUIPMENT LABEL INSTALLATION**

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.
- C. Contractor shall provide laminated labels secured above cylinder racks with labels reading “full” or “empty” as shown on the drawings. Lettering shall be 2 inches in height.

### **3.4 PIPE LABEL INSTALLATION**

- A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures, on both sides.
  - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. Near origination and termination points.
  - 7. Spaced at maximum intervals of **15** on center along each run. Reduce intervals to **10 feet** on center in areas of congested piping and equipment, such as Mechanical and Boiler Rooms.
  - 8. On piping above removable acoustical ceilings.
- B. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- C. Stenciling of piping and/or insulation is not acceptable.

### **3.5 VALVE-TAG INSTALLATION**

- A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

**END OF SECTION**

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**SECTION 22 0719  
PLUMBING PIPING INSULATION**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section includes insulating the following plumbing piping services:
  - 1. Domestic cold-water piping.
  - 2. Domestic hot-water piping.
  - 3. Domestic recirculating hot-water piping.
  - 4. Roof drains and roof drain leaders.
  - 5. Condensate drainage piping.
  - 6. Supplies and drains for handicap-accessible lavatories and sinks.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

**1.4 QUALITY ASSURANCE**

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

**1.6 COORDINATION**

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application.

**1.7 SCHEDULING**

- A. Schedule insulation application after pressure testing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

**PART 2 - PRODUCTS**

**2.1 INSULATION MATERIALS**

- A. Comply with requirements in "Indoor Piping Insulation Schedule," articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

- D. Fibrous Glass Pipe Insulation: Incombustible, pre-molded, Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. CertainTeed Manson, Knauf FiberGlass GmbH, Owens-Corning Fiberglas Corp., Schuller International, Inc.
  - 2. Preformed Pipe Insulation with Factory-Applied ASJ.
  - 3. Thermal Conductivity: 0.24 BTU/in/hr/ft<sup>2</sup> at 100°F.
- E. Flexible Elastomeric Insulation: Closed-cell materials. Comply with ASTM C 534, Type I for tubular materials.

## **2.2 INSULATING CEMENTS**

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

## **2.3 ADHESIVES**

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. PVC Jacket Adhesive: Compatible with PVC jacket.

## **2.4 MASTICS**

- A. Mastics shall be as recommended by insulation material manufacturer, and shall be compatible with all insulation materials.

## **2.5 FACTORY-APPLIED JACKETS**

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
  - 1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

# **PART 3 - EXECUTION**

## **3.1 EXAMINATION**

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  - 1. Verify that systems to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## **3.2 PREPARATION**

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

## **3.3 GENERAL INSTALLATION REQUIREMENTS**

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.

- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Apply adhesives and mastics at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
    - a. For below-ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- O. For above-ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.
  - 4. Cleanouts.
- P. Rigid pipe insulation inserts shall be provided for all insulated piping 2" and larger.

### **3.4 PENETRATIONS**

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Pipe insulation at all fire separations shall be butted tightly to the firewall or to the floor after fire stop material has been installed.
  - 1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- C. Insulation Installation at Floor Penetrations:
  - 1. Pipe: Install insulation continuously through floor penetrations.
  - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

### **3.5 INSTALLATION OF GLASS-FIBER INSULATION**

- A. Insulation Installation on Straight Pipes and Tubes:
  - 1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
  - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic. Apply vapor retarder to ends of insulation at intervals of 15 to 20 feet to form a vapor retarder between pipe insulation and segments.

3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
  4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic.
- B. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
  2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire, tape, or bands.
  3. All pipe insulation for pipe fittings shall be pre-molded to fit fittings and shall be enclosed under pre-molded PVC fitting jacket.
- C. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
  2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
  3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

### **3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION**

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of pipe insulation.
  2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### **3.7 FIELD-APPLIED JACKET INSTALLATION**

- A. All insulated piping exposed to the weather shall be protected with color coded 30 mil PVC jacket cemented in place with PVC fitting covers. Color coding shall be in accordance with ANSI standards.

### **3.8 FINISHES**

- A. Paint finished insulation as specified in Division 9 Section "Painting", and Section 220553 "Identification of Plumbing Piping and Equipment".
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

### **3.9 PIPING INSULATION SCHEDULE, GENERAL**

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Underground piping.
  2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

### **3.10 INDOOR PIPING INSULATION SCHEDULE**

- A. Domestic Cold Water:
1. Insulation shall be the following:
    - a. Glass-Fiber: 1" thick.

- b. Where installed below grade, insulation shall be 1/2" thick closed cellular plastic foam insulation.
  - c. Where installed within CMU walls or chases made using CMU walls, insulation shall be 1" thick flexible elastomeric insulation.
- B. Domestic Hot Water:
  - 1. NPS 1-1/2 and Smaller: Insulation shall be the following:
    - a. Glass-Fiber: 1" thick.
  - 2. NPS 2 and Larger: Insulation shall be the following:
    - a. Glass-Fiber: 2" thick.
  - 3. Where installed within CMU walls or chases made using CMU walls, insulation shall be 1" thick flexible elastomeric insulation.
- C. Domestic Hot Water Return:
  - 1. Insulation shall be the following:
    - a. Glass-Fiber: 1" thick.
- D. Roof Drain Leaders:
  - 1. Insulation shall be the following:
    - a. Glass-Fiber: 1" thick.
    - b. When necessary, insulation for vertical roof drain leader piping within exterior walls may be reduced to 1/2" thick.
  - 2. Where installed within CMU walls or chases made using CMU walls, insulation shall be 1" thick flexible elastomeric insulation.
- E. Roof Drain Drain Bodies:
  - 1. Insulation shall be the following:
    - a. 1" thick insulating cement insulation.
- F. Condensate Drainage Piping:
  - 1. Insulation shall be the following:
    - a. Glass-Fiber: 1" thick.
  - 2. Where installed within CMU walls or chases made using CMU walls, insulation shall be 1" thick flexible elastomeric insulation.
- G. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
  - 1. A.D.A. approved premolded insulation assembly as manufactured by Truebro, McGuire or Mainline .
- H. Contractor **may request** that closed cellular foam insulation be used on insulated piping when the building structure is not "dried in" to protect fibrous glass insulation from getting wet. Foam insulation thermal properties shall match or exceed the specified thermal insulation properties for the intended usage. Insulation shall be secured with 16 gauge copper wire at 16 inch centers.

**END OF SECTION**

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**SECTION 22 1116  
DOMESTIC WATER PIPING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Copper tube and fittings.
  - 2. Piping joining materials.
  - 3. Encasement for piping.
  - 4. Transition fittings.
  - 5. Dielectric fittings.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Water quality test report.

**1.5 QUALITY ASSURANCE**

- A. Piping material shall bear label, stamp, or other markings of specified testing agency.

**PART 2 - PRODUCTS**

**2.1 PIPING MATERIALS**

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372.

**2.2 COPPER TUBE AND FITTINGS**

- A. Hard Copper Tube: **ASTM B 88, Type L** water tube, drawn temper.
- B. Soft Copper Tube: **ASTM B 88, Type K** water tube, annealed temper.
- C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- E. Copper Unions:
  - 1. MSS SP-123.
  - 2. Cast-copper-alloy, hexagonal-stock body.
  - 3. Ball-and-socket, metal-to-metal seating surfaces.
  - 4. Solder-joint or threaded ends.
- F. Copper, Brass, or Bronze Pressure Seal Joint Fittings:
  - 1. Manufacturers: Viega Propress, Mueller, or NIBCO.
  - 2. Fittings: Cast-brass, cast-bronze or wrought-copper with EPDM O-ring seal in each end. Sizes NPS 2-1/2 and larger with stainless steel grip ring and EPDM O-ring seal. Fittings shall conform to ASME B16.18 or ASME B16.22 and performance criteria of IAPMO PS117.
  - 3. Minimum 200-psig working-pressure rating at 250 deg F.
  - 4. Pressure Seal Joint shall conform to ASME B16.51.

**2.3 PIPING JOINING MATERIALS**

- A. Solder Filler Metals: ASTM B 32, lead-free alloys, minimum melting point of 410 degrees Fahrenheit.
- B. Flux: ASTM B 813, water flushable.

- C. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated. Minimum melting point of 1000 degrees Fahrenheit.

## **2.4 TRANSITION FITTINGS**

- A. General Requirements:
  - 1. Same size as pipes to be joined.
  - 2. Pressure rating at least equal to pipes to be joined.
  - 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

## **2.5 DIELECTRIC FITTINGS**

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
  - 1. Standard: ASSE 1079.
  - 2. Pressure Rating: 125 psig minimum at 180 deg F.
  - 3. End Connections: Solder-joint copper alloy and threaded ferrous.

## **PART 3 - EXECUTION**

### **3.1 EARTHWORK**

- A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

### **3.2 PIPING INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."
- D. Arrange all pipes to freely drain through a ball valve when water is cut off.
- E. Branch valves shall be installed adjacent to the water piping main.
- F. All supplies to fixtures shall have individual stop valves.
- G. Install shutoff valve immediately upstream of each dielectric fitting.
- H. Provide water hammer shock arrestors as required to prevent water hammer. Air chambers are not acceptable. 12" x 12" access door shall be provided for all shock arrestors.
- I. Install domestic water piping level and plumb.
- J. All exposed piping to fixtures shall be chrome plated installed true and plumb.
- K. Install piping concealed from view in walls, below floors, or above ceilings and protected from physical contact by building occupants except where exposed for connections to fixtures and as otherwise indicated and except in equipment rooms and service areas. Install and secure all piping as walls are built. Wedging of piping will not be permitted. All piping shall be isolated from mortar.
- L. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.



- M. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- N. Install piping to permit valve servicing.
- O. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- P. Install piping free of sags and bends.
- Q. Install fittings for changes in direction and branch connections.
- R. All tees shall be installed such that the flow shall be straight thru the tee and/or out the side. Tees **shall not** be installed where the flow is into the side and out of both ends of the tee (bullhead tee). Bullhead tees installations are not acceptable and shall not be used.
- S. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty, and as indicated in the Contract Drawings.
- T. All water piping shall be routed with a minimum clearance of ten (10) feet from any electrical switchboards, panel boards or telephone backboards.
- U. Extend water lines to water mains where shown on the plans.
- V. Terminate cold water line 5-feet outside building. Connection at this point will be by the Site Contractor.
- W. Insulate all water piping inside the building. Comply with requirements in Section 220719 "Plumbing Piping Insulation."
- X. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."
- Y. Comply with requirements in Section 221123 "Domestic Water Pumps."
- Z. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- AA. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

### 3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools and procedure recommended by pressure-seal-fitting manufacturer. Leave insertion marks on pipe after assembly. Upon completion of the project, the press fitting manufacturer's tools used for installation shall be turned over to the Owner.
- G. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

**3.4 TRANSITION FITTING INSTALLATION**

- A. Install transition couplings at joints of dissimilar piping.

**3.5 DIELECTRIC FITTING INSTALLATION**

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

**3.6 HANGER AND SUPPORT INSTALLATION**

- A. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

**3.7 CONNECTIONS**

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
  - 1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
  - 2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
  - 3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

**3.8 IDENTIFICATION**

- A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

**3.9 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:
  - 1. Piping Inspections:
    - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
    - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
      - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
      - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
    - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
    - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
  - 2. Piping Tests:
    - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
    - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
    - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.

- d. Cap and subject piping to static water pressure of 150 psig. Isolate test source and allow it to stand for a minimum of four hours. Leaks and loss in test pressure constitute defects that must be repaired.
  - e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained. No caulking of joints will be permitted.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. The Contractor shall furnish all necessary equipment, materials and labor to perform the above-specified test.

### **3.10 ADJUSTING**

- A. Perform the following adjustments before operation:
  - 1. Close drain valves, hydrants, and hose bibbs.
  - 2. Open shutoff valves to fully open position.
  - 3. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
  - 4. Remove and clean strainer screens. Close drain valves and replace drain plugs.
  - 5. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
  - 6. Check plumbing specialties and verify proper settings, adjustments, and operation.

### **3.11 CLEANING**

- A. Clean and disinfect potable domestic water piping as follows:
  - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
  - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
    - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    - b. Fill and isolate system according to either of the following:
      - 1) The solution shall remain in the piping for a minimum period of 6 hours, during which time valves shall be opened and closed to permit a small flow of the solution. At the end of the six (6) hours, the solution shall be tested and must contain a residual of at least 5 to 10 ppm chlorine.
    - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    - d. Repeat procedures if biological examination shows contamination.
    - e. The Contractor shall contract with an independent Testing Laboratory for a certification letter that the system sterilization meets or exceed standards for potable water.
    - f. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

### **3.12 PIPING SCHEDULE**

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Underground, domestic water piping, NPS 3 and smaller shall be the following:
  - 1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings.
- C. Aboveground domestic water piping, NPS 1-1/4 and smaller, shall be one of the following:
  - 1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and soldered joints.
  - 2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.

- D. Aboveground domestic water piping, NPS 1-1/2 to NPS 4, shall be one of the following:
  - 1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
  - 2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.

**3.13 VALVE SCHEDULE**

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Shutoff Duty: Use ball valves with solder ends for piping NPS 1-1/4 and smaller. Use ball valves with threaded ends for piping NPS 1-1/2 and 2. Use flanged end iron body ball valves for piping NPS 2-1/2 and larger.
  - 2. Check Valves: Check valves 2 inch and small shall be Class 125, lead free design cast bronze body with threaded ends. Valves 2-1/2 inch and larger shall be Class 125, cast iron body with flanged ends.
  - 3. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

**END OF SECTION**

**SECTION 22 1119  
DOMESTIC WATER PIPING SPECIALTIES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Vacuum breakers.
  - 2. Backflow preventers.
  - 3. Temperature-actuated, water mixing valves.
  - 4. Strainers.
  - 5. Outlet boxes.
  - 6. Hose bibbs.
  - 7. Wall hydrants.
  - 8. Water-hammer arresters.
- B. Related Requirements:
  - 1. Section 220519 "Meters and Gauges for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
  - 2. Section 224716 "Pressure Water Coolers" for water filters for water coolers.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

**1.4 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

**PART 2 - PRODUCTS**

**2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES**

- A. Potable-water piping and components shall comply with NSF 61 and NSF 14.
- B. Comply with NSF 372 for low lead.

**2.2 VACUUM BREAKERS**

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
  - 1. Watts, Zurn, Conbraco.
  - 2. Standard: ASSE 1001.
  - 3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
  - 4. Body: Bronze.
  - 5. Inlet and Outlet Connections: Threaded.
  - 6. Finish: Chrome plated.

**2.3 BACKFLOW PREVENTERS**

- A. Reduced-Pressure-Principle Backflow Preventers RPZ:
  - 1. Watts LF909S or approved equal by Wilkins, Febco, or Conbraco.
  - 2. Standard: AWWA C-511, ASSE 1013.
  - 3. Operation: Continuous-pressure applications.
  - 4. Size: Same as connected pipe size, see Contract Drawings.
  - 5. Body: Bronze.
  - 6. End Connections: Threaded for NPS 2 and smaller.
  - 7. Configuration: Designed for horizontal, straight-through flow.
  - 8. Accessories:

- a. Valves NPS 2 and Smaller: Gate type with threaded ends on inlet and outlet.
  - b. Air-Gap Fitting: Manufacturer supplied, ASSE 1013, matching backflow-preventer connection.
  - c. Strainer: Manufacturer supplied.
  - d. Test Valves.
- B. Double-Check, Backflow-Prevention Assemblies:
  - 1. Watts LF007S, or approved equal by Wilkins, Febco, or Conbraco.
  - 2. Standard: AWWA C-510, ASSE 1015.
  - 3. Operation: Continuous-pressure applications unless otherwise indicated.
  - 4. Size: Same as connected pipe size, see Contract Drawings.
  - 5. Body: Bronze.
  - 6. End Connections: Threaded for NPS 2 and smaller.
  - 7. Configuration: Designed for horizontal, straight-through flow.
  - 8. Accessories:
    - a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.

## 2.4 TEMPERATURE-ACTUATED, WATER MIXING VALVES

- A. Individual-Fixture, Water Tempering Valves (Lavatories):
  - 1. Watts LFMMV or approved equal by Conbraco or Heatguard.
  - 2. Standard: ASSE 1070 or CSA B125.3.
  - 3. Body: Lead Free cast copper silicon alloy.
  - 4. Temperature Control: Adjustable with locking set point.
  - 5. Inlets and Outlet: Threaded
  - 6. Finish: Rough or chrome-plated bronze.
  - 7. Tempered-Water Setting: 110 deg F.
  - 8. Tempered-Water Design Flow Rate: 0.5 gpm.
  - 9. Accessories: Integral filter washers and check valves.
- B. Individual-Fixture, Water Tempering Valves (Counter Sinks):
  - 1. Watts LFMMV or approved equal by Conbraco or Heatguard.
  - 2. Standard: ASSE 1070 or CSA B125.3.
  - 3. Body: Lead Free cast copper silicon alloy.
  - 4. Temperature Control: Adjustable with locking set point.
  - 5. Inlets and Outlet: Threaded
  - 6. Finish: Rough or chrome-plated bronze.
  - 7. Tempered-Water Setting: 110 deg F.
  - 8. Tempered-Water Design Flow Rate: 1.5 gpm.
  - 9. Accessories: Integral filter washers and check valves.

## 2.5 STRAINERS FOR DOMESTIC WATER PIPING

- A. Y-Pattern Strainers:
  - 1. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated for NPS 2-1/2 and larger.
  - 2. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
  - 3. Screen: Stainless steel with round perforations unless otherwise indicated.
  - 4. Drain: Factory-installed, hose-end drain valve.

## 2.6 OUTLET BOXES

- A. Icebreaker Connection Box CB-1:
  - 1. LSP Products Group OB-801, IPS Corporation AB9700, or approved equal by Oatey.
  - 2. Mounting: Recessed.
  - 3. Material and Finish: Plastic box and faceplate.
  - 4. Faucet: Valved fitting. Include NPS 1/2 or smaller copper tube outlet. Compression nut and ferrule.

5. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.

**B. Washer Connection Box CB-2:**

1. Acorn 8180 or approved equal by Oatey or LSP Products Group. Provide manufacturers 22 gage type 304 stainless steel extended collar, Acorn M8292-E503-1, where wall thickness exceeds 3/4".
2. Mounting: Recessed.
3. Material and Finish: Stainless steel box, extended collar where applicable, and faceplate.
4. Faucet: Separate lead free hot- and cold-water valved fittings. Include garden-hose thread on outlets.
5. Supply Shutoff Fittings: NPS 3/4" gate, globe, or ball valves and NPS 3/4" copper, water tubing.
6. Drain: NPS 2 standpipe and P-trap for direct waste connection to drainage piping.
7. Inlet Hoses: Two 60-inch-long, rubber household clothes washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.
8. Drain Hose: One 48-inch-long, rubber household clothes washer drain hose with hooked end.
9. Accessories: Overflow guard.

**2.7 HOSE BIBBS**

**A. Hose Bibb HB-1:**

1. Woodford Model 26P-1/2, Mifab MHY-9240, T & S Brass B-0702/B-972 or Preir C-257CP.75.
2. Body Material: Polished chrome plated brass.
3. Seat: Bronze, replaceable.
4. Supply Connections: Threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral hose-connection vacuum breaker complying with ASSE 1011.
8. Operation: Operating key.
9. Include operating key with each operating-key hose bibb.
10. Include integral wall flange with each chrome-plated hose bibb.

**B. Hose Bibb In Box HB-2:**

1. Woodford Model B26-1/2-CH, Mifab MHY-95-49 or Metcraft Model 182.
2. Body Material: Rough brass.
3. Accessories: Cast brass or 304 stainless steel wall box, hinged door, loose key door lock, chrome plated or stainless steel exposed finish.
4. Seat: Bronze, replaceable.
5. Supply Connections: Threaded or solder-joint inlet.
6. Outlet Connection: Garden-hose thread.
7. Pressure Rating: 125 psig.
8. Vacuum Breaker: Integral hose-connection vacuum breaker complying with ASSE 1011.
9. Operation: Wheel handle.
10. Include operating key for box with each hose bibb.

**2.8 WALL HYDRANTS**

**A. Nonfreeze Wall Hydrant HB-3:**

1. Woodford Model 67, Zurn Model Z-1310 or Josam Model 71050-12.
2. Pressure Rating: 125 psig.
3. Operation: Loose key.
4. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
5. Outlet: Exposed, with integral vacuum breaker and garden-hose thread.

6. Nozzle and Wall-Plate Finish: Chrome
7. Operating Keys(s): One with each wall hydrant.
8. Self Draining.

## 2.9 WATER-HAMMER ARRESTERS

- A. Water-Hammer Arresters:
  1. Precision Plumbing Products, Inc. or approved equal by Zurn, Josam, J.R. Smith, or Sioux Chief.
  2. Standard: ASSE 1010.
  3. Type: **Copper tube with piston.**
  4. Size: ASSE 1010, Sizes AA and A through F.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Backflow Preventers: Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
  1. Locate backflow preventers in same room as connected equipment or system.
  2. Do not install bypass piping around backflow preventers.
  3. Install piping to drain air gap fittings indirectly over nearest floor drain, unless otherwise indicated on Contract Drawings.
  4. Install pressure gauges at inlet and outlet of backflow preventers per Section 220519 "Meters and Gages for Plumbing Piping."
- B. Temperature-Actuated, Water Mixing Valves: Install with check stops or shutoff valves on inlets and with shutoff valve on outlet.
- C. Y-Pattern Strainers: For water, install on supply side of each pump and mixing valve serving an individual fixture.
- D. Outlet Boxes: Install boxes recessed in wall. Install 2-by-4-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."
- E. Water-Hammer Arresters: Install in water piping according to PDI-WH 201, and manufacturer's instructions and recommendations.
- F. Supply-Type, Trap-Seal Primer Device: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

### 3.2 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.
- C. Comply with requirements for grounding equipment in Section 260526 "Grounding and Bonding for Electrical Systems."

### 3.3 IDENTIFICATION

- A. Plastic Labels for Equipment: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
  1. Water Meter
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."



**3.4 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:
  - 1. Test each pressure vacuum breaker and backflow-prevention assembly according to authorities having jurisdiction and the device's reference standard. All backflow preventers shall be tested and certified by an approved and licensed backflow prevention company.
- B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- C. Prepare backflow preventer test and inspection reports.

**3.5 ADJUSTING**

- A. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

**END OF SECTION**

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**SECTION 22 1123  
DOMESTIC WATER PUMPS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. In-line, sealless centrifugal pumps.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product. Include construction materials, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.

**1.4 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For inline, domestic-water pumps to include in operation and maintenance manuals.
- B. Startup Report.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Retain shipping flange protective covers and protective coatings during storage.
- B. Protect bearings and couplings against damage.
- C. Comply with pump manufacturer's written instructions for handling.

**PART 2 - PRODUCTS**

**2.1 PERFORMANCE REQUIREMENTS**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. UL Compliance: UL 778 for motor-operated water pumps.
- C. Drinking Water System Components - Health Effects and Drinking Water System Components - Lead Content Compliance: NSF 61 and NSF 372.

**2.2 IN-LINE, SEALLESS CENTRIFUGAL PUMPS**

- A. Description: Factory-assembled and -tested, in-line, close-coupled, canned-motor, sealless, overhung-impeller centrifugal pumps.
- B. Taco, B&G, or Grundfos.
- C. Capacities and Characteristics: As indicated on Contract Drawings.
- D. Pump shall be specifically designed for domestic hot water service.
- E. Pump Construction:
  - 1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft horizontal.
  - 2. Casing: Bronze, with threaded or companion-flange connections.
  - 3. Impeller: Plastic.
  - 4. Motor: Single speed.
  - 5. Pump shall be direct connected to motor.
  - 6. Motor shall be rubber mounted and shall be equipped with overload protection.

**2.3 CONTROLS**

- A. Aquastats: Electric, adjustable for control of domestic hot water circulator pumps.

1. Type: Strap-on type, with adjustable range, mounted directly on the building hot water recirculating lines.
2. Operation of Pump: On or off.
3. Transformer: Provide if required.
4. Power Requirement: 120 V ac.
5. Settings: As indicated on Contract Drawings.
6. Connection to DDC-Controlled Circuit: DDC-Circuit shall energize pump during occupied hours, as set by the Owner. See Controls Schematics for full list of items to be monitored.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine roughing-in for domestic-water-piping system to verify actual locations of piping connections before pump installation.

#### **3.2 PUMP INSTALLATION**

- A. Circulator pumps shall be supported by appropriate hangers to avoid piping strain.
- B. Circulator pumps shall be mounted horizontally.
- C. Install Circulator Pumps in locations and at heights to allow access for maintenance from floor.
- D. Install Aquastats as indicated on Contract Drawings. Temperature settings shall be as indicated on Contract Drawings.
- E. See Contract Drawings for delineation of work between Divisions 22 and 26.

#### **3.3 IDENTIFICATION**

- A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment" for identification of pumps.

#### **3.4 STARTUP SERVICE**

- A. Engage a factory-authorized service representative to perform startup service.
  1. Complete installation and startup checks according to manufacturer's written instructions.
  2. Check piping connections for tightness.
  3. Clean strainers on suction piping.
  4. Set Aquastats for automatic starting and stopping operation of pumps.
  5. Perform the following startup checks for each pump before starting:
    - a. Verify bearing lubrication.
    - b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
    - c. Verify that pump is rotating in the correct direction.
  6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
  7. Start motor.
  8. Open discharge valve slowly.

#### **3.5 ADJUSTING**

- A. Adjust inline, domestic-water pumps to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust initial temperature set points.
- C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

#### **3.6 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train the Owner's Maintenance Personnel to adjust, operate, and maintain pumps.

### **END OF SECTION**

**SECTION 22 1316  
SANITARY WASTE AND VENT PIPING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Hub-and-spigot, cast-iron soil pipe and fittings.
  - 2. Hubless, cast-iron soil pipe and fittings.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

**PART 2 - PRODUCTS**

**2.1 PERFORMANCE REQUIREMENTS**

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
  - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

**2.2 PIPING MATERIALS**

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

**2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS**

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Piping shall carry country of origin, manufacturer's name or manufacturer's registered trade-mark.
- C. Fittings shall be of the sanitary drainage pattern and conforming to piping specification and shall be marked with the Cast Iron Soil Pipe Institute symbol cast into the fitting.
- D. Gaskets: ASTM C 564, Neoprene, push joint type.

**2.4 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS**

- A. Pipe and Fittings: CISPI 301.
- B. Fittings shall be of the sanitary drainage pattern and conforming to piping specification and shall be marked with the Cast Iron Soil Pipe Institute symbol cast into the fitting.
- C. Piping shall carry country of origin, manufacturer's name or manufacturer's registered trade-mark.
- D. CISPI, Hubless-Piping Couplings:
  - 1. Standards: CISPI 310.
  - 2. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and Neoprene sleeve with integral, center pipe stop.
  - 3. Bands shall be same manufacturer as piping and shall carry the NSF Logo.

**PART 3 - EXECUTION**

**3.1 EARTH MOVING**

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

### 3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
  - 1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
  - 2. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install all horizontal and vertical piping true and plumb to building structure and connect all piping with 'Y' branches and 1/8 or 1/16 bends.
- D. Run all piping as directly as possible, avoiding unnecessary bends and turns so as not to interfere with proper installation of work of other contractors.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Grade all waste lines 2" and smaller 1/4" per foot.
- H. Grade all waste lines 3" and larger 1/4" per foot, where possible, 1/8" per foot minimum. Grade shall be 1/8" per foot where indicated on Contract Drawings.
- I. Grade all condensate drain lines 1/8" per foot.
- J. All underground piping shall be graded by the use of a laser beam alignment system.
- K. Install piping free of sags and bends.
- L. Install fittings for changes in direction and branch connections.
- M. Install piping to allow application of insulation (where applicable).
- N. Tapped tees and crosses will not be permitted. Tapped sanitary tees and crosses shall be used.
- O. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
- P. Reducing size of waste piping in direction of flow is prohibited
- Q. Comply with requirements for cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."
- R. Do not enclose, cover, or put piping into operation until it is tested, and inspected and approved by authorities having jurisdiction.
- S. Vents shall be tied together as shown with minimum number of vents extending through roof. All vents extended through the roof shall be a minimum of 12" above roof level.
- T. Flashing of plumbing vents will be provided by the Roof Contractor.
- U. Install sleeves for piping penetrations of walls, ceilings, and floors.
  - 1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- V. Install sleeve seals for piping penetrations of concrete walls and slabs.
  - 1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- W. Install escutcheons for piping penetrations of walls, ceilings, and floors.
  - 1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

### 3.3 JOINT CONSTRUCTION

- A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

- B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1.
  - 1. Cut threads full and clean using sharp dies.
  - 2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
    - a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
    - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
    - c. Do not use pipe sections that have cracked or open welds.

### **3.4 HANGER AND SUPPORT INSTALLATION**

- A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Support horizontal cast iron soil pipe with a minimum of one hanger for each pipe length. Location close to hub or no-hub connector. Support vertical pipe at each floor or at intervals not exceeding 10-feet.

### **3.5 CONNECTIONS**

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect waste and vent piping to the following:
  - 1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
  - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
  - 3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
  - 4. Equipment: Connect waste piping as indicated.
- C. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

### **3.6 IDENTIFICATION**

- A. Identify sanitary waste and vent piping.
- B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

### **3.7 FIELD QUALITY CONTROL**

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. All sanitary waste, vent and condensate drainage piping shall be tested in the following manner: Plug all openings and fill entire waste and vent system to overflow with water and sustain a constant level for a minimum period of three hours. All portions of the floor system shall be tested under a minimum of a 10-foot head including roof vent terminal.
- D. All tests shall be applied before any work is concealed or covered in any manner.
- E. The Contractor shall furnish all necessary equipment, materials and labor to perform the above-specified tests.

- F. Piping will be considered defective if it does not pass tests and inspections.

**3.8 CLEANING AND PROTECTION**

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Repair damage to adjacent materials caused by waste and vent piping installation.
- E. The Contractor shall flush all waste piping prior to final connection to existing system, to ensure that no foreign materials are in these lines, and that a continuous flow of water and waste can be affected.

**3.9 PIPING SCHEDULE**

- A. Aboveground, waste, vent, grease waste vent, waste oil vent, condensate, and sump pump discharge piping shall be one of the following:
  - 1. Hubless, cast-iron soil pipe and fittings, hubless-piping couplings, and coupled joints.
- B. Underground, waste, vent, grease waste, grease waste vent, waste oil, waste oil vent, condensate, and sump pump discharge piping shall be one of the following:
  - 1. Service class, hub and spigot cast-iron soil piping; gasketed joints.

**END OF SECTION**



**SECTION 22 1319  
SANITARY WASTE PIPING SPECIALTIES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Floor drains.
  - 2. Floor sinks.
  - 3. Cleanouts.
  - 4. Miscellaneous sanitary drainage piping specialties.
- B. Related Requirements:
  - 1. Section 221423 "Storm Drainage Piping Specialties" for roof drains.
  - 2. Section 221323 "Sanitary Waste Interceptors."

**1.3 DEFINITIONS**

- A. ABS: Acrylonitrile-butadiene-styrene.
- B. PVC: Polyvinyl chloride.

**1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

**1.5 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For sanitary waste piping specialties to include in emergency, operation, and maintenance manuals.

**PART 2 - PRODUCTS**

**2.1 ASSEMBLY DESCRIPTIONS**

- A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

**2.2 FLOOR DRAINS**

- A. Floor Drain FD-1:
  - 1. Zurn ZN415-BZ1-VP, or approved equal by Josam, Sioux Chief, or Watts.
  - 2. Pattern: Floor drain.
  - 3. Body Material: Cast iron.
  - 4. Outlet: 4" Bottom.
  - 5. Top or Strainer Material: Nickel bronze.
  - 6. Top of Body and Strainer Finish: Nickel bronze.
  - 7. Top Shape: Round
  - 8. Dimensions of Top or Strainer: 6" x 6".
  - 9. Top Loading Classification: Medium Duty.
  - 10. Trap Material: Same as connected piping.
  - 11. Trap Pattern: Deep-seal P-trap.
  - 12. Features: Heelproof top, post pour adjustment, concrete shield, adjustable collage with seepage slots, vandal resistant securing screws with flashing device.
  - 13. Install 4" in-line floor drain trap seal, ABS plastic housing with EPDM rubber diaphragm and soft rubber sealing gasket, conforming to ASSE 1072, SureSeal SS4009V or approved equal, as a separate item.
- B. Floor Drain FD-2:
  - 1. Zurn ZN415-BZ1-VP, or approved equal by Josam, Sioux Chief, or Watts.

2. Pattern: Floor drain.
  3. Body Material: Cast iron.
  4. Outlet: 2" Bottom.
  5. Top or Strainer Material: Nickel bronze.
  6. Top of Body and Strainer Finish: Nickel bronze.
  7. Top Shape: Square.
  8. Dimensions of Top or Strainer: 6" x 6".
  9. Top Loading Classification: Medium Duty.
  10. Trap Material: Same as connected piping.
  11. Trap Pattern: Deep-seal P-trap.
  12. Features: Heelproof top, post pour adjustment, concrete shield, adjustable collar with seepage slots, vandal resistant securing screws with flashing device.
- C. Floor Drain (Emergency Eyewash/Showers):
1. Refer to Section 224500 "Emergency Plumbing Fixtures"
  2. Zurn ZN415-BZ1-VP, or approved equal by Josam, Sioux Chief, or Watts.
  3. Pattern: Floor drain.
  4. Body Material: Cast iron.
  5. Outlet: 4" Bottom.
  6. Top or Strainer Material: Nickel bronze.
  7. Top of Body and Strainer Finish: Nickel bronze.
  8. Top Shape: Square.
  9. Dimensions of Strainer: 8".
  10. Top Loading Classification: Medium Duty.
  11. Trap Material: Same as connected piping.
  12. Trap Pattern: Deep-seal P-trap.
  13. Features: Heelproof top, post pour adjustment, concrete shield, adjustable collar with seepage slots, vandal resistant securing screws with flashing device.
  14. Install 4" in-line floor drain trap seal, ABS plastic housing with EPDM rubber diaphragm and soft rubber sealing gasket, conforming to ASSE 1072, SureSeal SS4009V or approved equal, as a separate item.

## 2.3 FLOOR SINKS

- A. Floor Sink FS-1:
1. Zurn Z-1901-K-2-33, or approved equal by Josam or J. R. Smith.
  2. Pattern: Floor drain.
  3. Body Material: Cast iron.
  4. Anchor Flange: Required.
  5. Outlet: 3" Bottom.
  6. Coating on Interior Surfaces: White acid-resistant enamel.
  7. Internal Strainer: Dome.
  8. Internal Strainer Material: White acid resistant dome.
  9. Top Grate Material: Nickel Bronze.
  10. Top of Body and Grate Finish: Nickel bronze.
  11. Top Shape: Square, 1/2 grate.
  12. Dimensions of Top Grate: 12" x 12".
  13. Depth: 8".
  14. Trap Material: Same as connected piping.
  15. Trap Pattern: Deep-seal P-trap.

## 2.4 CLEANOUTS

- A. Cast-Iron Exposed Cleanouts CO:
1. Size: Same as connected branch, maximum of 4".
  2. Body Material: As required to match connected piping.

3. Description: Pipe cap installed using a no-hub band and clamp.
- B. Cast-Iron Wall Cleanouts WCO:
  1. Zurn ZS-1468, Josam 58600-PLG, or J. R. Smith 4472.
  2. Size: Same as connected drainage piping, maximum of 4".
  3. Body: As required to match connected piping.
  4. Closure Plug:
    - a. Cast Bronze slotted plug.
  5. Wall Access: Round, stainless steel, vandalproof securing screw.
- C. Cast-Iron Exposed Floor Cleanouts FCO:
  1. Zurn ZN-1400, or approved equal by Josam or J. R. Smith.
  2. Size: Same as connected branch, maximum of 4".
  3. Type: Threaded, adjustable housing.
  4. Body or Ferrule: Cast iron.
  5. Closure: Cast brass plug, lead seal with straight threads and watertight gasket.
  6. Frame and Cover Material and Finish: Nickel-bronze.
  7. Frame and Cover Shape: Round.
  8. Top Loading Classification: Medium Duty.
- D. Cast-Iron Exposed Exterior Cleanouts ECO:
  1. Zurn Z-1403-BP-NL, or approved equal by Josam or J. R. Smith.
  2. Size: Same as connected branch, maximum of 4".
  3. Type: Non-adjustable.
  4. Body or Ferrule: Cast iron.
  5. Closure: ABS taper threaded plug.
  6. Frame and Cover Material and Finish: Cleanout shall be installed in 24" x 24" x 6" concrete pad.
  7. Top Loading Classification: Heavy Duty.

## 2.5 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

- A. Hub Drains HD-1:
  1. Description: Shop or field fabricate from piping material as specified for condensate drainage piping in Section 221316 "Sanitary Waste and Vent Piping."
  2. Size: Same as connected waste piping.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
  1. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.
    - a. Maintain integrity of waterproof membranes where penetrated.
  2. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
  1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
  2. Locate at each change in direction of piping greater than 135 degrees.
  3. Locate at minimum intervals of 100 feet.
  4. Locate at base of each vertical soil and waste stack.
  5. Locate wall cleanouts located in group toilet rooms 18" above finished floor to the centerline, unless otherwise required due to coordination with other trades.
  6. Where indicated on Contract Drawings.

- C. Removable caps and plugs for cleanouts shall have at least six threads engaged.
- D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- F. For exterior cleanouts, install flush with grade and within 24" x 24" x 6" thick concrete pad per Contract Drawings.
- G. Install through-penetration firestop assemblies.
  - 1. Comply with requirements in Section 078413 "Penetration Firestopping" and Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- H. Assemble Hub Drains and install with top of hub 1 inch above floor.
- I. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- J. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane. Comply with requirements of Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- K. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

### **3.2 CONNECTIONS**

- A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

### **3.3 FLASHING INSTALLATION**

- A. Flashing shall be provided and installed by Roof Contractor.

### **3.4 PROTECTION**

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.
- C. All floor drains, floor sinks, and hub drains shall be covered immediately after installation.

**END OF SECTION**

**SECTION 22 1323  
SANITARY WASTE INTERCEPTORS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Trough Drain w/ Lint Filter.

**1.3 DEFINITIONS**

- A. FRP: Fiberglass-reinforced plastic.
- B. PP: Polypropylene plastic.

**1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of interceptor. Include materials of fabrication, dimensions, rated capacities, retention capacities, operating characteristics, size and location of each pipe connection, furnished specialties, and accessories.

**PART 2 - PRODUCTS**

**2.1 TROUGH DRAIN WITH LINT FILTER**

- A. Striem Tuff Trough TT-3 or approved equal.
- B. Polyethylene: 3/4" Polyethylene.
- C. Removable access lid.
- D. Corrosion-resistant primary filter screen with 1/2" perforations and secondary filter basket with overflow protection.
- E. Field fabricated inlet full-sized to match discharge connection at extractor.
- F. 4" outlet.

**PART 3 - EXECUTION**

**3.1 EARTHWORK**

- A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

**3.2 INSTALLATION**

- A. Set interceptors level and plumb.
- B. Install access doors of lint filters flush with finished floor.

**3.3 CONNECTIONS**

- A. Piping installation requirements are specified in Section 221316 "Sanitary Waste and Vent Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Make piping connections between interceptors/filters and piping systems.

**3.4 PROTECTION**

- A. Protect sanitary waste interceptors and filters from damage during construction period.
- B. Repair damage to adjacent materials caused by sanitary waste interceptor and filter installations.

**END OF SECTION**

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**SECTION 22 1413  
FACILITY STORM DRAINAGE PIPING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Hub-and-spigot, cast-iron soil pipe and fittings.
  - 2. Hubless, cast-iron soil pipe and fittings.
- B. Related Requirements:
  - 1. Section 334400 "Stormwater Utility Equipment" for storm drainage piping outside the building.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:

**1.4 QUALITY ASSURANCE**

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

**PART 2 - PRODUCTS**

**2.1 PERFORMANCE REQUIREMENTS**

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
  - 1. Storm Drainage Piping: 10-foot head of water.

**2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS**

- A. Pipe and Fittings: ASTM A 74, Service class.
- B. Piping shall carry country of origin, manufacturer's name or manufacturer's registered trade-mark.
- C. Fittings shall be of the sanitary drainage pattern and conforming to piping specification and shall be marked with the Cast Iron Soil Pipe Institute symbol cast into the fitting.
- D. Gaskets: ASTM C 564, Neoprene, push joint type.

**2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS**

- A. Pipe and Fittings: CISPI 301.
- B. Fittings shall be of the sanitary drainage pattern and conforming to piping specification and shall be marked with the Cast Iron Soil Pipe Institute symbol cast into the fitting.
- C. Piping shall carry country of origin, manufacturer's name or manufacturer's registered trade-mark.
- D. CISPI, Hubless-Piping Couplings:
  - 1. Standards: CISPI 310.
  - 2. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and Neoprene sleeve with integral, center pipe stop.
  - 3. Bands shall be same manufacturer as piping and shall carry the NSF Logo.
- E. Heavy-Duty, Hubless-Piping Couplings:
  - 1. Standard: ASTM C 1540.
  - 2. Description: Joints for hubless cast iron piping shall be made using heavy duty no hub couplings comprised of elastomeric gasket conforming to ASTM C 564 housed inside a 304 stainless steel corrugated shield. Couplings shall have no less than 4 stainless steel

clamping bands each. Clamping bands shall have stainless steel bolts torqued to manufacturer's specifications. The entire coupling shall be corrosion resistant and conform to ASTM C 1540.

### **PART 3 - EXECUTION**

#### **3.1 EARTH MOVING**

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

#### **3.2 PIPING INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
  - 1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
  - 2. Install piping as indicated unless deviations from layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install all horizontal and vertical piping true and plumb to building structure and connect all piping with 'Y' branches and 1/8 or 1/16 bends.
- D. Run all piping as directly as possible, avoiding unnecessary bends and turns so as not to interfere with proper installation of work of other contractors.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes as indicated on Contract Drawings.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation (where applicable).
- K. Tapped tees and crosses will not be permitted. Tapped sanitary tees and crosses shall be used.
- L. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
- M. Reducing size of drainage piping in direction of flow is prohibited.
- N. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
  - 1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.
- O. Comply with requirements for cleanouts and drains specified in Section 221423 "Storm Drainage Piping Specialties."
- P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- Q. Install sleeves for piping penetrations of walls, ceilings, and floors.
  - 1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- R. Install sleeve seals for piping penetrations of concrete walls and slabs.
  - 1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- S. Install escutcheons for piping penetrations of walls, ceilings, and floors.
  - 1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."



**3.3 JOINT CONSTRUCTION**

- A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Hubless, Cast-Iron Soil Piping Coupled Joints:
  - 1. Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

**3.4 HANGER AND SUPPORT INSTALLATION**

- A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Support horizontal cast iron pipe with a minimum of one hanger for each pipe length. Location close to hub or no-hub connector. Support vertical pipe at each floor or at intervals not exceeding 10-feet.

**3.5 CONNECTIONS**

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect storm drainage piping to roof drains and storm drainage specialties.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance.

**3.6 IDENTIFICATION**

- A. Identify storm drainage piping.
- B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

**3.7 FIELD QUALITY CONTROL**

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. The roof drain leader piping system shall be tested in the following manner: Plug pipe outlet and fill entire under floor system with water under a 10-foot head above finished floor and sustain a constant level for a minimum period of three (3) hours. All piping above the lowest floor level shall be tested from a test tee installed at that level with the entire system filled with water into drain body and sustain the constant level for a period of three (3) hours.
- D. All tests shall be applied before any work is concealed or covered in any manner.
- E. The Contractor shall furnish all necessary equipment, materials and labor to perform the above-specified tests.
- F. Piping will be considered defective if it does not pass tests and inspections.

**3.8 CLEANING AND PROTECTION**

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Repair damage to adjacent materials caused by storm drain piping installation.

**3.9 PIPING SCHEDULE**

- A. Aboveground roof drain leader piping shall be one of the following:
  - 1. Hubless, cast-iron soil pipe and fittings, hubless-piping couplings, and coupled joints.
- B. Underground roof drain leader piping shall be one of the following:
  - 1. Service class, hub and spigot cast-iron soil piping; gasketed joints.

**END OF SECTION**

**SECTION 22 1423  
STORM DRAINAGE PIPING SPECIALTIES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Metal roof drains.
  - 2. Miscellaneous storm drainage piping specialties.
  - 3. Cleanouts.
- B. Related Requirements:
  - 1. Section 076200 "Sheet Metal Flashing and Trim" for penetrations of roofs.
  - 2. Section 078413 "Penetration Firestopping" for firestopping roof penetrations.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

**1.4 QUALITY ASSURANCE**

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

**PART 2 - PRODUCTS**

**2.1 METAL ROOF DRAINS**

- A. Cast-Iron, Large-Sump, General-Purpose Roof Drains RD:
  - 1. Zurn ZC-100-DP-E or approved equal by Josam, J. R Smith, Wade or Watts
  - 2. Body Material: Cast iron.
  - 3. Dimension of Body: Nominal 15-inch diameter.
  - 4. Combination Flashing Ring and Gravel Stop: Required.
  - 5. Outlet: Bottom.
  - 6. Outlet Type: No hub.
  - 7. Extension Collars: Required. Height shall be as shown on architectural drawings.
  - 8. Top Set Deck Plate: Required.
  - 9. Dome Material: Galvanized Cast iron.
  - 10. Water Dam: Not required.

**2.2 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES**

- A. Downspouts:
  - 1. Zurn Z199-ZANB-SS series or approved equal by Josam, Wade or J. R. Smith.
  - 2. Description: Nickel Bronze downspout nozzle.
  - 3. Provide with manufacturer's stainless steel screen. Screen shall be secured in place.
  - 4. Size: Inlet size to match overflow drain outlet as indicated on Contract Drawings.

**2.3 CLEANOUTS**

- A. Cast-Iron Exposed Cleanouts CO:
  - 1. Size: Same as connected branch, maximum of 4".
  - 2. Body Material: As required to match connected piping.
  - 3. Description: Pipe cap installed using a no-hub band and clamp.
- B. Cast-Iron Wall Cleanouts WCO:
  - 1. Zurn ZS-1468, Josam 58600-PLG, or J. R. Smith 4472.
  - 2. Size: Same as connected drainage piping, maximum of 4".
  - 3. Body: As required to match connected piping.

4. Closure Plug:
  - a. Cast Bronze slotted plug.
5. Wall Access: Round, stainless steel, vandalproof securing screw.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Roof drains shall be provided by the Plumbing Contractor and installed where shown on the architectural roof plan by the Roof Contractor. The Plumbing Contractor shall connect to these roof drains and install the collector and leader system as shown on the plans.
- B. Install downspouts on outlet of roof drain leaders where indicated on plans at a height of 24" above finished grade.
- C. Install cleanouts in aboveground roof drain leader piping according to the following instructions unless otherwise indicated:
  1. Use cleanouts the same size as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
  2. Locate cleanouts at each change in direction of piping greater than 135 degrees.
  3. Locate cleanouts at minimum intervals of 100 feet.
  4. Locate cleanouts at base of each vertical roof drain leader.
  5. Where indicated on Contract Drawings.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.
- F. Install through-penetration firestop assemblies for penetrations of fire- and smoke-rated assemblies.
  1. Comply with requirements in Section 078413 "Penetration Firestopping" and "Penetration Firestopping" and Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

#### **3.2 CONNECTIONS**

- A. Comply with requirements for piping specified in Section 221413 "Facility Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

#### **3.3 FLASHING INSTALLATION**

- A. Flashing shall be provided and installed by Roof Contractor.

#### **3.4 PROTECTION**

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

### **END OF SECTION**

**SECTION 22 1500  
FUEL GAS PIPING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Pipes, tubes, and fittings.
  - 2. Piping specialties.
  - 3. Piping and tubing joining materials.
  - 4. Manual gas shutoff valves.
  - 5. Pressure regulators.
  - 6. Dielectric fittings.

**1.3 DEFINITIONS**

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

**1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

**1.5 QUALITY ASSURANCE**

- A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

**PART 2 - PRODUCTS**

**2.1 PIPES, TUBES, AND FITTINGS**

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
  - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern, with threads conforming to ASME B1.20.1.
  - 2. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.

**2.2 PIPING SPECIALTIES**

- A. Appliance Flexible Connectors: AGA approved.

**2.3 JOINING MATERIALS**

- A. Joint Compound and Tape: Suitable for natural gas.

- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

## **2.4 MANUAL GAS SHUTOFF VALVES**

- A. One-Piece, Full-Port Bronze Ball Valve with Bronze Trim: MSS SP-110.
  - 1. Body: Bronze, complying with ASTM B 584 and ASME B16.44.
  - 2. Ball: Chrome-plated brass.
  - 3. Stem: Bronze; blowout proof.
  - 4. Seats: Reinforced TFE; blowout proof.
  - 5. Packing: Separate packnut with adjustable-stem packing threaded ends.
  - 6. Ends: Threaded,.
  - 7. CWP Rating: 600 psig.
  - 8. Listing: UL or AGA.
  - 9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
  - 10. Provide gauge tapping on each ball valve controlling a single piece of equipment.
  - 11. Valve must be labeled "2G" per the NC State Fuel Gas Code.

## **2.5 PRESSURE REGULATORS**

- A. General Requirements:
  - 1. Maxitrol, American Meter Company, or Invensys
  - 2. Comply with ANSI Z21.80.
  - 3. Single stage and suitable for natural gas.
  - 4. Capacities as indicated on Contract Drawings.
  - 5. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.
  - 6. Regulators installed inside the building shall be of the limited venting design.

## **2.6 DIELECTRIC FITTINGS**

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
  - 1. Description:
    - a. Standard: ASSE 1079.
    - b. Pressure Rating: 125 psig minimum at 180 deg F.
    - c. End Connections: Solder-joint copper alloy and threaded ferrous.

# **PART 3 - EXECUTION**

## **3.1 EXAMINATION**

- A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## **3.2 PREPARATION**

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- B. Inspect natural-gas piping according to NFPA 54 and the NC Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with NFPA 54 and the NC Fuel Gas Code requirements for prevention of accidental ignition.

## **3.3 OUTDOOR PIPING INSTALLATION**

- A. Comply with NFPA 54 and the NC State Fuel Gas Code] for installation and purging of natural-gas piping.
- B. Install fittings for changes in direction and branch connections.

### 3.4 INDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 and the NC Fuel Gas Code for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Locate valves for easy access.
- G. Install natural-gas piping at uniform grade of 1/4" per 15 feet down toward drip and sediment traps.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Verify final equipment locations for roughing-in.
- K. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- L. Prohibited Locations:
  - 1. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
  - 2. Do not install natural-gas piping in solid walls or partitions.
- M. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- N. Connect branch piping from top or side of horizontal piping.
- O. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
- P. Do not use natural-gas piping as grounding electrode.
- Q. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
- R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

### 3.5 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance.
- B. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.
- C. Each valve shall be lubricated and turned during the installation to assure good working order. Plug valves shall be greased again after turning to aid the shut off.

### **3.6 PIPING JOINT CONSTRUCTION**

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
  - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
  - 2. Cut threads full and clean using sharp dies.
  - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
  - 4. Joints for threaded piping shall be made using pipe dope applied sparingly to the male thread of pipe. Pipe dope shall be resistant to actions of gas.
  - 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
  - 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
  - 2. Bevel plain ends of steel pipe.
  - 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

### **3.7 HANGER AND SUPPORT INSTALLATION**

- A. Comply with requirements for pipe hangers and supports specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

### **3.8 CONNECTIONS**

- A. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- B. Install piping adjacent to appliances to allow service and maintenance of appliances.
- C. Connect piping to appliances using manual gas shutoff valves and unions. Install union between valve and appliances or equipment.
- D. Drip Leg: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance. Drip legs shall be full size of the main and shall be 6 inches in length.

### **3.9 LABELING AND IDENTIFYING**

- A. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for piping and valve identification.

### **3.10 PAINTING**

- A. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for painting of piping.

### **3.11 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
- B. All tests shall be applied before any work is concealed or covered in any manner.
- C. Tests and Inspections:
  - 1. All fuel gas piping shall be tested by applying an air pressure of 100-lbs. per square inch and shall be maintained for minimum of eight (8) hours. Air receivers shall be charged with peppermint for odor test and any indication of leakage will be checked by applying a soap and water solution at each joint to determine leaking joint. Test shall be conducted using an eight inch pressure-temperature recorder with a pressure range of 0-150-psi with a 24 hour recording time. Pressure measuring elements shall be heat treated to prevent hysteresis-related inaccuracies. The original chart with copies shall be included in the "Owners and Operating Manuals."
- D. Natural-gas piping will be considered defective if it does not pass tests and inspections.



- E. The Contractor shall furnish all necessary equipment, materials and labor to perform the above-specified test.
- F. Prepare test and inspection reports.

**3.12 INDOOR PIPING SCHEDULE**

- A. Aboveground piping NPS 2 and smaller shall be the following:
  - 1. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground piping NPS 2-1/2" and larger shall be the following:
  - 1. Steel pipe with wrought-steel fittings and welded joints.

**END OF SECTION**

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**SECTION 22 3300**  
**ELECTRIC, DOMESTIC-WATER HEATERS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Thermostat-control, electric, tankless, domestic-water heaters.
  - 2. Domestic-water heater accessories.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

**1.4 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For electric, domestic-water heaters to include in emergency, operation, and maintenance manuals.
- B. Startup Report.

**1.5 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.
- C. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

**1.6 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including storage tank and supports.
    - b. Faulty operation of controls.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
  - 2. Warranty Periods: From date of Final Acceptance.
    - a. Electric, Tankless, Domestic-Water Heaters: Three year(s).

**PART 2 - PRODUCTS**

**2.1 ELECTRIC, TANKLESS, DOMESTIC-WATER HEATERS**

- A. Thermostat-Control, Electric, Tankless, Domestic-Water Heaters WH-2:
  - 1. Chronomite Laboratories, Inc. R-58L/208 or approved equal by Eemax or Stiebel Eltron
  - 2. Standard: UL 499 for electric, tankless, (domestic-water heater) heating appliance.
  - 3. Construction: Copper piping or tubing complying with NSF 61 Annex G barrier materials for potable water, without storage capacity.
    - a. Connections: ASME B1.20.1 pipe thread.
    - b. Heating Element: Resistance heating system.
    - c. Temperature Control: Thermostat.
    - d. Safety Control: High-temperature-limit cutoff device or system.
    - e. Jacket: Aluminum or steel with enameled finish or plastic.
  - 4. Support: Bracket for wall mounting.
  - 5. Capacity and Characteristics:

- a. Flow Rate: 1.5 gpm at 55 deg F temperature rise.
- b. Temperature Setting: **110** deg F.
- c. Power Demand: 12.05 kw.
- d. Electrical Characteristics:
  - 1) Volts: 208.
  - 2) Phases: 1.
  - 3) Hertz: 60.

## **2.2 DOMESTIC-WATER HEATER ACCESSORIES**

- A. Comply with requirements for ball shutoff valves specified in Section 220523 "General-Duty Ball Valves for Plumbing Piping."
- B. Comply with requirements for balancing valves specified in Section 221119 "Domestic Water Piping Specialties."
- C. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.
- D. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

## **2.3 SOURCE QUALITY CONTROL**

- A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test domestic-water heaters to minimum of one and one-half times pressure rating before shipment.
- C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.
- D. Prepare test and inspection reports.

# **PART 3 - EXECUTION**

## **3.1 DOMESTIC-WATER HEATER INSTALLATION**

- A. Electric, Tankless, Domestic-Water Heater Mounting: Install electric, tankless, domestic-water heaters where indicated on contract drawings.
  - 1. Maintain manufacturer's recommended clearances.
  - 2. Arrange units so controls and devices that require servicing are accessible.
  - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 5. Anchor domestic-water heaters to substrate.
  - 6. Do not install water heater or associated disconnect directly below water piping.
- B. Install electric, domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
  - 1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523 "General-Duty Valves for Plumbing Piping."
- C. Install combination temperature-and-pressure relief valves in water piping for electric, domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain if not otherwise indicated on Contract Drawings.
- D. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric,

domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."

- E. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."
- F. Fill electric, domestic-water heaters with water.

### **3.2 CONNECTIONS**

- A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping."
- B. Drawings indicate general arrangement of piping, fittings, and specialties.
- C. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

### **3.3 IDENTIFICATION**

- A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

### **3.4 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
  - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.
- C. Water heater shall be started by a factory-authorized service representative.
- D. Prepare test and inspection reports.

### **3.5 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain, electric, domestic-water heaters.

**END OF SECTION**

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**SECTION 22 3400  
FUEL-FIRED, DOMESTIC-WATER HEATERS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Commercial, gas-fired, high-efficiency, storage, domestic-water heaters.
  - 2. Domestic-water heater accessories.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

**1.4 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.
- B. Startup Report.

**1.5 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.
- C. ASME Compliance:
  - 1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
  - 2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

**1.6 COORDINATION**

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

**1.7 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including storage tank and supports.
    - b. Faulty operation of controls.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
    - d. Failure due to thermal shock.
  - 2. Warranty Periods: From date of Final Acceptance.
    - a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:
      - 1) Storage Tank: Three years.
      - 2) Controls and Other Components: One year.
    - b. Commercial, Finned-Tube, Gas-Fired, Domestic-Water Heaters:

- 1) Parts and Controls: One year.
- 2) Failure due to thermal shock: Five Years.
- 3) Separate Hot-Water Storage Tanks:
  - a) Parts and Controls: One year.
  - b) Failure due to thermal shock: Five Years.

## **PART 2 - PRODUCTS**

### **2.1 COMMERCIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS**

- A. Water Heater WH-1:
1. A.O. Smith BTH-500, or approved equal by State or Bradford White.
  2. Characteristics:
    - a. Temperature Setting: 140 deg F.
    - b. Storage Capacity: 119 gallons.
    - c. Reheat Capacity: 576 gallons per hour at 100 deg F temperature rise.
    - d. Fuel Gas Demand: 500 MBH.
  3. Storage-Tank Construction: Galvanized steel.
    - a. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
    - b. Lining: Glass complying with NSF 61 Annex G barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.
  4. Factory-Installed Storage-Tank Appurtenances:
    - a. Anode Rod: Replaceable magnesium.
    - b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
    - c. Insulation: Foam glass tank insulation, complying with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
    - d. Jacket: Steel with enameled finish.
    - e. Burner: UL 795 for pre-set power-burner, gas-fired, domestic-water heaters and natural gas fuel.
    - f. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 199, electric, automatic, gas-ignition system.
    - g. Temperature Control: Adjustable thermostat.
    - h. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
    - i. Combination Temperature-and-Pressure Relief Valves: ASME rated. Include one relief valve with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Relief valve shall have sensing element that extends into storage tank.
    - j. Hand hole cleanouts.
    - k. Flame sensor.
  5. Electrical Characteristics: Burner motor and controls shall be factory wired for 120-volt, single-phase electrical service.

### **2.2 DOMESTIC-WATER HEATER ACCESSORIES**

- A. Domestic-Water Expansion Tanks:
1. Amtrol, Bell and Gossett, Thrush or Taco.
  2. Description: ASME, steel, pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
  3. Construction:
    - a. Fittings shall include test cocks, hose bibb drain and air control fitting.
    - b. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
    - c. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.



- d. Air-Charging Valve: Factory installed.
- 4. Capacity and Characteristics:
  - a. Working-Pressure Rating: 150 psig.
  - b. Working-Temperature Rating: 200°F.
  - c. Capacity Acceptable: Minimum capacity as indicated on Contract Drawings.
- B. Comply with requirements for ball shutoff valves specified in Section 220523 "General-Duty Ball Valves for Plumbing Piping."
- C. Comply with requirements for gas valves, pressure regulators, and connections as specified in Section 221500 "Fuel Gas Piping"

### **2.3 SOURCE QUALITY CONTROL**

- A. Factory Tests: Test and inspect assembled domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test domestic-water heaters to minimum of one and one-half times pressure rating before shipment.
- C. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.
- D. Prepare test and inspection reports.

## **PART 3 - EXECUTION**

### **3.1 DOMESTIC-WATER HEATER INSTALLATION**

- A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
  - 1. Maintain manufacturer's recommended clearances.
  - 2. Arrange units so controls and devices that require servicing are accessible.
  - 3. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
  - 4. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
  - 5. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 6. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 7. Anchor domestic-water heaters to substrate.
- B. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
  - 1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523 "General-Duty Valves for Plumbing Piping."
- C. Install gas-fired, domestic-water heaters according to NFPA 54 and the NC State Fuel Gas Code.
  - 1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
  - 2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
  - 3. Comply with requirements for gas shutoff valves and gas pressure regulators specified in Section 221500 "Fuel Gas Piping."

- D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain if not otherwise indicated on Contract Drawings.
- E. Install water-heater drain piping as indirect waste to spill by positive air gap over floor drains if not otherwise indicated on Contract Drawings. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."
- F. Install thermometers and pressure gauges as indicated on Contract Drawings. Comply with requirements specified in Section 220519 "Meters and Gages for Plumbing Piping."
- G. Fill domestic-water heaters with water.
- H. Charge domestic-water expansion tanks with air.

### **3.2 CONNECTIONS**

- A. Comply with requirements for domestic-water piping specified in Section 221116 "Domestic Water Piping."
- B. Comply with requirements for gas piping specified in Section 221500 "Fuel Gas Piping."
- C. Drawings indicate general arrangement of piping, fittings, and specialties.
- D. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.
- E. Intake and exhaust connections to heaters shall be made using Schedule 40 CPVC pipe. Intake shall be equipped with manufacturer's recommended screen.

### **3.3 IDENTIFICATION**

- A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

### **3.4 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
  - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.
- C. Water heater shall be started by a factory-authorized service representative.
- D. Prepare test, inspection, and startup reports.

### **3.5 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain domestic-water heaters.

**END OF SECTION**

**SECTION 22 4213.13  
COMMERCIAL WATER CLOSETS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Water closets.
  - 2. Flushometer valves.
  - 3. Toilet seats.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
  - 2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

**1.4 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For water closets, flushometer valves and seats to include in operation and maintenance manuals.

**1.5 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than six of each type.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. All water closets shall flush properly when flushing with 25 PSIG at the flush valve.

**2.2 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS**

- A. Water Closet (Adult ADA) WC-1: Floor mounted, bottom outlet, top spud.
  - 1. Zurn Z5665-BWL1-AM, or approved equal by Sloan or American Standard.
  - 2. Bowl:
    - a. Material: Vitreous china.
    - b. Type: Siphon jet.
    - c. Style: Flushometer valve.
    - d. Height: 16-3/4"
    - e. Rim Contour: Elongated.
    - f. Water Consumption: 1.28 gal per flush.
    - g. Spud Size and Location: NPS 1-1/2; top.
    - h. Color: White.
    - i. Provide antimicrobial coating.
    - j. Provide china caps.
  - 3. Flushometer Valve: Manual.
- B. Water Closet (Adult Standard) WC-2: Floor mounted, bottom outlet, top spud.
  - 1. Zurn Z5655-BWL1-AM, approved equal by Sloan or American Standard.
  - 2. Bowl:
    - a. Material: Vitreous china.
    - b. Type: Siphon jet.

- c. Style: Flushometer valve.
  - d. Height: 15".
  - e. Rim Contour: Elongated.
  - f. Water Consumption: 1.28 gal per flush.
  - g. Spud Size and Location: NPS 1-1/2; top.
  - h. Color: White.
  - i. Provide antimicrobial coating.
  - j. Provide china caps.
- 3. Flushometer Valve: Manual.
- C. Water Closet (Adult ADA) WC-3: Floor mounted, bottom outlet, top spud.
  - 1. Zurn Z5655-BWL1-AM, or approved equal by Sloan or American Standard.
  - 2. Bowl:
    - a. Material: Vitreous china.
    - b. Type: Siphon jet.
    - c. Style: Flushometer valve.
    - d. Height: 16-3/4".
    - e. Rim Contour: Elongated.
    - f. Water Consumption: 1.28 gal per flush.
    - g. Spud Size and Location: NPS 1-1/2; top.
    - h. Color: White.
    - i. Provide antimicrobial coating.
    - j. Provide china caps.
  - 3. Flushometer Valve: Manual.

## 2.3 FLUSHOMETER VALVES

- A. Manual:
  - 1. Lever-Handle, Diaphragm Flushometer Valve.
  - 2. Zurn Z6000AV or approved equal by Sloan or American Standard.
  - 3. Features: Include integral check stop, vandal resistant stop cap, ADA flush handle, dual seal, clog-resistant diaphragm, and backflow-prevention device.
  - 4. Material: Brass body with corrosion-resistant components.
  - 5. Exposed Flushometer-Valve Finish: Chrome plated.
  - 6. Style: Exposed, with chrome plated cast brass escutcheon with set screw.
  - 7. Consumption: 1.28 gal. per flush.
  - 8. Minimum Inlet: NPS 1.
  - 9. Minimum Outlet: NPS 1-1/2.

## 2.4 TOILET SEATS

- A. Toilet Seats (Elongated Rim Water Closets):
  - 1. American Standard 5901.100, Church No. 9500CT, Centoco 1500CCSS, Bemis 1955SSCT, or Benekee 527.
  - 2. Material: Plastic.
  - 3. Type: Commercial (Heavy-Duty).
  - 4. Shape: Elongated rim, open front.
  - 5. Hinge: Check (concealed).
  - 6. Hinge Material: Stainless steel.
  - 7. Seat Cover: Not required.
  - 8. Color: White.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.

- B. Examine walls and floors for suitable conditions where water closets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Water-Closet Installation:
  - 1. Install level and plumb according to roughing-in drawings.
  - 2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
- B. Support Installation:
  - 1. Use carrier supports with waste-fitting assembly and seal.
  - 2. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.
- C. Flushometer-Valve Installation:
  - 1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
  - 2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
  - 3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
  - 4. Contractor should note flush valve rough-in height as shown on the drawings.
- D. Install toilet seats on water closets.
- E. Wall Flange and Escutcheon Installation:
  - 1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
  - 2. Install deep-pattern escutcheons if required to conceal protruding fittings.
  - 3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- F. Joint Sealing:
  - 1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
  - 2. Match sealant color to water-closet color.
  - 3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

### **3.3 CONNECTIONS**

- A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

### **3.4 ADJUSTING**

- A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

### **3.5 CLEANING AND PROTECTION**

- A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed water closets and fittings.
- C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

**END OF SECTION**

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**SECTION 22 4213.16  
COMMERCIAL URINALS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Urinals.
  - 2. Flushometer valves.
  - 3. Supports.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for urinals.
  - 2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

**1.4 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For urinals and flushometer valves to include in operation and maintenance manuals.

**1.5 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than six of each type.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. All urinals shall flush properly when flushing with 20 PSIG at the flush valve.

**2.2 WALL-HUNG URINALS**

- A. Urinal (Adult ADA) U-1: Wall hung, back outlet, siphon jet..
  - 1. Fixture: Zurn Z5755-U or approved equal by Sloan or American Standard
    - a. Material: Vitreous china.
    - b. Type: Siphon jet.
    - c. Strainer or Trapway: **Manufacturer's standard strainer** with integral trap.
    - d. Water Consumption: 0.125 gal. per flush.
    - e. Spud Size and Location: NPS 3/4; **top**.
    - f. Outlet Size and Location: NPS 2; back.
    - g. Color: **White**.
  - 2. Flushometer Valve: Zurn Z6003AV-ULF or approved equal by Sloan or American Standard.
    - a. Features: Include integral check stop and backflow-prevention device.
    - b. Material: Brass body with corrosion-resistant components.
    - c. Exposed Flushometer-Valve Finish: Chrome plated.
    - d. Style: Exposed.
    - e. Consumption: 0.125 gal. per flush.
    - f. Minimum Inlet: **NPS 3/4**.
    - g. Minimum Outlet: **NPS 3/4**.

- h. Features: Screwdriver angle stop valve, Dual seal clog resistant diaphragm, vandal resistant stop cap, ADA handle, vacuum breaker, and chrome-plated cast brass escutcheon with set screw.
  - 3. Waste Fitting:
    - a. Size: NPS 2.
  - 4. Support: Urinal Carrier.
  - 5. Urinal Mounting Height: As indicated on the Contract Drawings.
- A. Urinal (Adult Standard) U-2: Wall hung, back outlet, siphon jet..
- 1. Fixture: Zurn Z5755-U or approved equal by Sloan or American Standard
    - a. Material: Vitreous china.
    - b. Type: Siphon jet.
    - c. Strainer or Trapway: **Manufacturer's standard strainer** with integral trap.
    - d. Water Consumption: 0.125 gal. per flush.
    - e. Spud Size and Location: NPS 3/4; **top**.
    - f. Outlet Size and Location: NPS 2; back.
    - g. Color: **White**.
  - 2. Flushometer Valve: Zurn Z6003AV-ULF or approved equal by Sloan or American Standard.
    - a. Features: Include integral check stop and backflow-prevention device.
    - b. Material: Brass body with corrosion-resistant components.
    - c. Exposed Flushometer-Valve Finish: Chrome plated.
    - d. Style: Exposed.
    - e. Consumption: 0.125 gal. per flush.
    - f. Minimum Inlet: **NPS 3/4**.
    - g. Minimum Outlet: **NPS 3/4**.
    - h. Features: Screwdriver angle stop valve, Dual seal clog resistant diaphragm, vandal resistant stop cap, ADA handle, vacuum breaker, and chrome-plated cast brass escutcheon with set screw.
  - 3. Waste Fitting:
    - a. Size: NPS 2.
  - 4. Support: Urinal Carrier.
  - 5. Urinal Mounting Height: As indicated on the Contract Drawings.

### 2.3 SUPPORTS

- A. Urinal Carrier:
  - 1. Zurn Z-1222, or approved equal by J.R. Smith or Watts
  - 2. Features: Chair carrier with chrome plated cap nuts.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before urinal installation.
- B. Examine walls and floors for suitable conditions where urinals will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Urinal Installation:
  - 1. Install urinals level and plumb according to roughing-in drawings.
  - 2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
  - 3. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC/ANSI A117.1. Install trap-seal liquid in waterless urinals.
- B. Support Installation:
  - 1. Install supports, affixed to building substrate, for wall-hung urinals.



2. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
  3. Use carriers without waste fitting for urinals with tubular waste piping.
  4. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.
- C. Flushometer-Valve Installation:
1. Install flushometer-valve water-supply fitting on each supply to each urinal.
  2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
  3. Install lever-handle flushometer valves for accessible urinals with handle mounted on open side of compartment.
- D. Wall Flange and Escutcheon Installation:
1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
  2. Install deep-pattern escutcheons if required to conceal protruding fittings.
  3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- E. Joint Sealing:
1. Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
  2. Sealant color shall be clear.
  3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

### **3.3 CONNECTIONS**

- A. Connect urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match urinals.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to urinals, allow space for service and maintenance.

### **3.4 ADJUSTING**

- A. Operate and adjust urinals and controls. Replace damaged and malfunctioning urinals, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.

### **3.5 CLEANING AND PROTECTION**

- A. Clean urinals and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed urinals and fittings.
- C. Do not allow use of urinals for temporary facilities unless approved in writing by Owner.

**END OF SECTION**

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**SECTION 22 4216.13  
COMMERCIAL LAVATORIES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Lavatories.
  - 2. Faucets.
  - 3. Supply fittings.
  - 4. Waste fittings.
  - 5. Supports.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
  - 2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

**1.4 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.

**1.5 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
  - 2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

**PART 2 - PRODUCTS**

**2.1 ENAMELED, CAST-IRON, WALL-MOUNTED LAVATORIES**

- A. Lavatory-Wall Hung (Adult ADA) L-1: Rectangular, enameled, cast iron, wall mounted.
  - 1. Zurn Z5844, Sloan SS-3017 or approved equal by American Standard.
  - 2. Fixture:
    - a. Standard: ASME A112.19.1/CSA B45.2.
    - b. Type: Straight-front apron with straight back.
    - c. Nominal Size: 20 by 18 inches.
    - d. Faucet-Hole Punching: Three holes, 4-inch centers.
    - e. Faucet-Hole Location: Top.
    - f. Color: White.
    - g. Mounting Material: Wall hanger.
    - h. Features: Acid resistant, back ledge, front overflow.
  - 3. Faucet: Manual Dual Push-Button Metering.
  - 4. Support: Lavatory Carrier.
  - 5. Lavatory Mounting Height: As indicated on the Contract Drawings.

**2.2 VITREOUS CHINA, COUNTER-MOUNTED LAVATORIES**

- A. Countertop Lavatory L-2: Oval, vitreous china, undermount.
  - 1. American Standard No. 0495.221 or approved equal by Kohler, Sloan or Toto.

2. Fixture:
  - a. Nominal Size: 17 by 14 inches.
  - b. Faucet-Hole Punching: Three holes, 4-inch centers.
  - c. Faucet-Hole Location: Top.
  - d. Color: White.
  - e. Features: Front overflow, unglazed rim, mounting hardware.
3. Faucet: Manual Dual Push-Button Metering .
- B. Countertop Lavatory L-3: Oval, vitreous china, undermount.
  1. American Standard No. 0495.221 or approved equal by Kohler, Sloan or Toto.
  2. Fixture:
    - a. Nominal Size: 17 by 14 inches.
    - b. Faucet-Hole Punching: Three holes, 4-inch centers.
    - c. Faucet-Hole Location: Top.
    - d. Color: White.
    - e. Features: Front overflow, unglazed rim, mounting hardware.
  3. Faucet: Manual Dual Push-Button Metering .

### 2.3 **SOLID-BRASS, MANUALLY OPERATED FAUCETS**

- A. NSF Standard: Comply with NSF 372 for faucet materials that will be in contact with potable water.
- B. Manual Dual Push-Button Metering:
  1. Zurn Z86500-XL-3M, or approved equal by Delta, or Moen.
  2. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
  3. Body Type: Centerset.
  4. Body Material: Commercial, solid brass.
  5. Finish: Polished chrome plate.
  6. Maximum Flow Rate: 0.5 gpm.
  7. Maximum Flow: 0.25 gal. per metering cycle.
  8. Mounting Type: Deck, exposed
  9. Valve Handle(s): Dual Push button
  10. Spout: Rigid type.
  11. Spout Outlet: Vandal-Resistant Aerator.
  12. Connect to Individual-Fixture Tempering Valve per Section 221119 "Domestic Water Piping Specialties".

### 2.4 **SUPPLY FITTINGS**

- A. NSF Standard: Comply with NSF 372 for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated-brass, with 1/2" chrome plated nipple to wall and escutcheon with set screw and inlet connection matching supply piping. McGuire, Zurn, or Brass Craft.
- E. Operation: Loose key.
- F. Risers:
  1. NPS 3/8.
  2. Chrome-plated, braided stainless steel, flexible hose riser. McGuire, Brass Craft, or Watts.

### 2.5 **WASTE FITTINGS**

- A. Standard: ASME A112.18.2/CSA B125.2.

- B. Drain: Chrome plated cast brass strainer with open grid, overflow openings, cast brass locknut and 1-1/4" 17 gauge tailpiece shall be McGuire Model 155A, Zurn Model Z-8743, or Engineered Brass Company Model SG7L05.
- C. P-Trap:
  - 1. Size: NPS 1-1/2 by NPS 1-1/4.
  - 2. Chrome-plated, adjustable cast brass P-trap with 1-1/4" slip in inlet, cleanout, ground joint, 1-1/2" I.P.S. outlet, shall be McGuire, Zurn, or Engineered Brass Company.
  - 3. 1-1/2" chrome plated nipple to wall with escutcheon and setscrew shall be McGuire, Zurn, or Engineered Brass Company.

## **2.6 SUPPORTS**

- A. Lavatory Carrier:
  - 1. Zurn Model Z-1224, J. R. Smith Model 0800, or approved equal by Watts.
  - 2. Chair carrier with floor anchor plate, upright supports, and bearing plate.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.
- B. Examine counters and walls for suitable conditions where lavatories will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Install lavatories level and plumb according to roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-mounted lavatories.
- C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.
- D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Sealant color shall be clear. Comply with sealant requirements specified in Section 079200 "Joint Sealants."
- F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

### **3.3 CONNECTIONS**

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

### **3.4 ADJUSTING**

- A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

### **3.5 CLEANING AND PROTECTION**

- A. After completing installation of lavatories, inspect and repair damaged finishes.

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- B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed lavatories and fittings.
- D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

**END OF SECTION**

## **SECTION 22 4216.16 COMMERCIAL SINKS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Mop Receptors.
  - 2. Free standing sinks.
  - 3. Counter mounted sinks.
  - 4. Sink faucets.
  - 5. Supports.
  - 6. Supply fittings.
  - 7. Waste fittings.
- B. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
  - 2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

#### **1.3 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For sinks and faucets to include in maintenance manuals.

#### **1.4 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
  - 2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

### **PART 2 - PRODUCTS**

#### **2.1 MOP RECEPTORS**

- A. Mop Receptor MR-1: Molded Stone, floor mounted.
  - 1. Fiat Model MSB-2424, Williams Model MTB 2424 or Mustee Model 63.
  - 2. Fixture:
    - a. Shape: Square.
    - b. Nominal Size: 24 by 24 inches.
    - c. Height: 10 inches.
    - d. Drain: Stainless steel strainer with NPS 3 outlet. Drain shall be caulked. Plumbing Contractor shall install deep seal P-trap below floor as a separate item.
  - 3. Mounting: On floor and flush to wall.
  - 4. Faucet: Mop Receptor Faucet.
  - 5. Accessories: Accessories manufacturer shall be the same as mop receptor manufacturer.
    - a. Heavy duty, cloth reinforced rubber hose and hose hook: Fiat Model 832-AA, Williams Model T-35, or Mustee Model 65.700.
    - b. Wall mounted, 24" long, 3 mop spring clip hanger: Fiat Model 889-CC, Williams Model T-40, or Mustee Model 65.600.

#### **2.2 FREE STANDING SINKS**

- A. Two Compartment Sink SK-5: Stainless steel, 18 gauge, freestanding.

1. Elkay E2C16X20-2-18X, or approved equal by Fiat or Cashel.
2. Fixture:
  - a. Number of Compartments: Two.
  - b. Overall Dimensions: 70" x 26" x 43-3/4"
  - c. Compartment:
    - 1) Dimensions: 16" x 20" x 12".
    - 2) Drain: 3-1/2".
3. Supports: Stainless Steel legs and adjustable bullet feet.
4. Features: Left and Right Drainboards.
5. Faucet(s): Utility Sink Faucet.
  - a. Number Required: One.
  - b. Mounting: Backsplash.
6. Supply Fittings:
  - a. Sink supplies shall be installed using 1/2" type 'L' hard copper equipped with ball valve stops.
7. Waste Fittings:
  - a. P-Trap:
    - 1) McGuire, Zurn, or Engineered Brass Company.
    - 2) Size: NPS 1-1/2 x NPS 2.
    - 3) Material: Chrome-plated cast brass.
    - 4) Features: Adjustable, slip joint inlet, cleanout, ground joint.

### 2.3 COUNTER MOUNTED SINKS

- A. Staff Lounge Sink (ADA) SK-1: Stainless steel, double bowl, counter mounted.
  1. Elkay ELUHAD311845 or approved equal by Just or Advance Tabco.
  2. Fixture:
    - a. Type: Undermount.
    - b. Material: 18-gauge type 304 nickel bearing stainless steel.
    - c. Nominal Size (Bowl): Approximately 13-1/2 by 16 inches by 4-3/8 inches deep.
    - d. Overall Dimensions: Approximately 30-3/4" by 18-1/2".
    - e. Features: Sound deadening applied to under side, customized with rear overflow.
  3. Faucet: Counter Sink Faucet, manual type, two lever handle, gooseneck.
    - a. Location: Center set deck mounted.
  4. Supply Fittings:
    - a. McGuire, Zurn, or Brasscraft.
    - b. 1/2" sweat x 1/2" compression sink supply stops shall be equipped with 5" extension, wheel handle ball valve angle stops.
    - c. Risers:
      - 1) NPS 3/8.
      - 2) Chrome-plated, braided stainless steel, flexible hose riser. McGuire, Brass Craft, or Watts.
  5. Waste Fittings:
    - a. Stainless steel crumbcup strainer with 1-1/2" offset tailpiece shall be Elkay LKAD35 or Just J-ADA-35 GR or approved equal by Advance Tabco.
    - b. Center Waste Continuous Outlet: McGuire 113C16G17, or approved equal by Elkay, or Zurn.
    - c. P-Trap:
      - 1) McGuire, Zurn, or Kohler.
      - 2) Size: NPS 1-1/2 x NPS 1-1/2".
      - 3) Material: Chrome-plated cast brass.
      - 4) Features: Adjustable, slip joint inlet, cleanout, 1-1/2" 17-gauge tube outlet.
- B. Classroom Sink (ADA) SK-2: Stainless steel, single bowl, counter mounted.
  1. Elkay ELUH1418 or approved equal by Just or Advance Tabco.



2. Fixture:
    - a. Type: Undermount.
    - b. Material: 18-gauge type 304 nickel bearing stainless steel.
    - c. Nominal Size: Approximately 14 by 18 inches by 7-7/8 inches deep.
    - d. Overall Dimensions: Approximately 16-1/2 by 20-1/2 inches.
    - e. Features: Sound deadening applied to under side, customized with rear overflow.
  3. Faucet: Counter Sink Faucet, manual type, two lever handle, gooseneck .
    - a. Location: Center set deck mounted.
  4. Supply Fittings:
    - a. McGuire, Zurn, or Brass Craft.
    - b. 1/2" sweat x 1/2" compression sink supply stops shall be equipped with 5" extension, wheel handle ball valve angle stops.
    - c. Risers:
      - 1) NPS 3/8.
      - 2) Chrome-plated, braided stainless steel, flexible hose riser. McGuire, Brass Craft, or Watts.
  5. Waste Fittings:
    - a. Stainless steel crumbcup strainer with 1-1/2" offset tailpiece shall be Elkay LKAD35 or Just J-ADA-35 GR or approved equal by Advance Tabco.
    - b. P-Trap:
      - 1) McGuire, Zurn, or Kohler.
      - 2) Size: NPS 1-1/2 x NPS 1-1/2".
      - 3) Material: Chrome-plated cast brass.
      - 4) Features: Adjustable, slip joint inlet, cleanout, 1-1/2" 17-gauge tube outlet.
- C. Student Lounge Sink (ADA) SK-3: Stainless steel, single bowl, counter mounted.
1. Elkay ELUHAD141855 or approved equal by Just or Advance Tabco.
  2. Fixture:
    - a. Type: Undermount.
    - b. Material: 18-gauge type 304 nickel bearing stainless steel.
    - c. Nominal Size: Approximately 14 by 18 inches by 5-3/8 inches deep.
    - d. Overall Dimensions: Approximately 16-1/2 by 20-1/2 inches.
    - e. Features: Sound deadening applied to under side, customized with rear overflow.
  3. Faucet: Counter Sink Faucet, manual type, two lever handle, gooseneck .
    - a. Location: Center set deck mounted.
  4. Supply Fittings:
    - a. McGuire, Zurn, or Brass Craft.
    - b. 1/2" sweat x 1/2" compression sink supply stops shall be equipped with 5" extension, wheel handle ball valve angle stops.
    - c. Risers:
      - 1) NPS 3/8.
      - 2) Chrome-plated, braided stainless steel, flexible hose riser. McGuire, Brass Craft, or Watts.
  5. Waste Fittings:
    - a. Stainless steel crumbcup strainer with 1-1/2" offset tailpiece shall be Elkay LKAD35 or Just J-ADA-35 GR or approved equal by Advance Tabco.
    - b. P-Trap:
      - 1) McGuire, Zurn, or Kohler.
      - 2) Size: NPS 1-1/2 x NPS 1-1/2".
      - 3) Material: Chrome-plated cast brass.
      - 4) Features: Adjustable, slip joint inlet, cleanout, 1-1/2" 17-gauge tube outlet.
- D. Counter Sink - Mock (ADA) SK-4: Stainless steel, double bowl, counter mounted.
1. Elkay ELUHAD311845 or approved equal by Just or Advance Tabco.
  2. Fixture:

- a. Type: Undermount.
- b. Material: 18-gauge type 304 nickel bearing stainless steel.
- c. Nominal Size (Bowl): Approximately 13-1/2 by 16 inches by 4-3/8 inches deep.
- d. Overall Dimensions: Approximately 30-3/4" by 18-1/2".
- e. Features: Sound deadening applied to under side, customized with rear overflow.
- 3. Faucet: Counter Sink Faucet, manual type, two lever handle, gooseneck.
  - a. Location: Center set deck mounted.
- 4. Supply Fittings: Not required.
- 5. Waste Fittings: Not required.

## 2.4 SINK FAUCETS

- A. NSF Standard: Comply with NSF 372 for faucet-spout materials that will be in contact with potable water.
- B. Mop Receptor Faucet: Manual type, two lever handle.
  - 1. Commercial, Solid-Brass Faucet.
  - 2. Chicago No. 540-LD89SWFXKCAB&4, T&S B-0665-BSTP or approved equal by Moen.
  - 3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies.
  - 4. Body Type: Centerset.
  - 5. Body Material: Commercial, solid brass.
  - 6. Finish: Polished chrome plated.
  - 7. Handle(s): Lever.
  - 8. Mounting Type: Back/wall, exposed.
  - 9. Spout Type: Rigid, solid brass with wall brace.
  - 10. Vacuum Breaker: Required for hose outlet.
  - 11. Spout Outlet: 3/4" Hose thread according to ASME B1.20.7.
  - 12. Features: Integral screwdriver shank check stops.
- C. Utility Sink Faucet: Manual type, two lever handle.
  - 1. Commercial, Solid-Brass Faucet.
  - 2. Chicago No. 540-LDL12ABCP or approved equal by Delta or Zurn.
  - 3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings.
  - 4. Body Type: Centerset.
  - 5. Body Material: Commercial, solid brass.
  - 6. Finish: Polished chrome plated.
  - 7. Handle(s): Lever.
  - 8. Mounting Type: Wall/Backsplash
  - 9. Spout Type: Swing, solid brass.
  - 10. Spout Outlet: Plain end.
- D. Counter Sink Faucet, manual type, two lever handle, gooseneck.
  - 1. Commercial, Solid-Brass Faucet.
  - 2. Chicago 1895-209607AB, or approved equal by Zurn or Delta.
  - 3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
  - 4. Body Type: Centerset.
  - 5. Body Material: Commercial, solid brass.
  - 6. Finish: Chrome plated.
  - 7. Maximum Flow Rate: 1.5 gpm.
  - 8. Handle(s): Vandal proof lever.
  - 9. Mounting Type: Deck, exposed.
  - 10. Spout Type: 8" Swivel gooseneck.
  - 11. Spout Outlet: Vandal proof aerator.
  - 12. Features: Renewable cartridge, less spray.

13. Connect to Individual-Fixture Tempering Valve per Section 221119 "Domestic Water Piping Specialties".
  - a. Exception: SK-4, Mock Apartment Faucet.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.
- B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 INSTALLATION**

- A. Install sinks level and plumb according to roughing-in drawings.
- B. Mop receptor supply faucets shall be mounted at height indicated on Contract Drawings.
- C. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.
- D. Set floor-mounted sinks in leveling bed of cement grout.
- E. Install water-supply piping with stop on each supply to each sink faucet.
  1. Exception: Use ball valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523 "General-Duty Valves for Plumbing Piping".
  2. Install stops in locations where they can be easily reached for operation.
- F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations, including within casework. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Sealant color shall be clear. Comply with sealant requirements specified in Section 079200 "Joint Sealants."
- H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

#### **3.3 CONNECTIONS**

- A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

#### **3.4 ADJUSTING**

- A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.

#### **3.5 CLEANING AND PROTECTION**

- A. After completing installation of sinks, inspect and repair damaged finishes.
- B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed sinks and fittings.
- D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

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**SECTION 22 4223  
COMMERCIAL SHOWERS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Shower valves.
  - 2. Shower heads.
  - 3. Shower drains.
  - 4. Grout.
- B. Related Requirements:
  - 1. Section 224500 "Emergency Plumbing Fixtures" for emergency showers.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for showers.
  - 2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

**1.4 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For shower faucets to include in maintenance manuals.

**1.5 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Faucet Washers and O-Rings: Equal to **10** percent of amount of each type and size installed.
  - 2. Faucet Cartridges and O-Rings: Equal to **5** percent of amount of each type and size installed.

**PART 2 - PRODUCTS**

**2.1 SHOWERS**

- A. NSF Standard: Comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects," and NSF 372 for shower materials that will be in contact with potable water.
- B. Shower (ADA) SH-1:
  - 1. Complete Shower Valve and Shower Head Package: Bradley 1C-HD-B1-LHV-B24-DV, or approved equal by Symmons or Leonard.
  - 2. Description: Single-handle, pressure-balance shower valve with hot- and cold-water indicators, check stops, diverter valve, shower head, and hand shower.
  - 3. Shower Valve:
    - a. Body Material: Bronze.
    - b. Finish: Polished chrome plate.
    - c. Flow: **1.5 gpm.**
    - d. Mounting: **Concealed.**
    - e. Operation: Single-handle, **twist or rotate** control.
    - f. Antiscald Device: **Integral with shower valve.**
    - g. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.
    - h. Supply Connections: NPS 1/2.

4. Diverter Valve:
    - a. Body Material: Bronze.
    - b. Finish: Polished chrome plate.
    - c. Mounting: **Concealed**.
    - d. Operation: Single-handle, **twist or rotate** control.
  5. Shower Head:
    - a. Type: **Ball joint with arm and flange**.
    - b. Shower Head Material: ABS with chrome-plated finish.
    - c. Spray Pattern: **Adjustable**
    - d. Integral Volume Control: **Lever Handle**
    - e. Flow: **2.0 gpm**.
  6. Hand Shower:
    - a. Type: **Hand spray with non-positive push button shut-off**.
    - b. Spray Pattern: **Fixed**.
    - c. Integral Volume Control: **Not required**.
    - d. Flow: **2.0 gpm**.
    - e. Features: Double check valve backflow preventer, 60" braided stainless steel flexible hose, 24" glide rail, supply elbow and flange.
  7. Mounting locations as indicated on Contract Drawings.
  8. Shower drain shall be floor drain with 2" outlet as specified in Section 221319 "Sanitary Waste Piping Specialties."
- C. Shower (Standard) SH-2:
1. Complete Shower Valve and Shower Head Package: Bradely 1C-HD-B1-LHV, or approved equal by Symmons or Leonard.
  2. Description: Single-handle, pressure-balance shower valve with hot- and cold-water indicators, check stops, and shower head.
  3. Shower Valve:
    - a. Body Material: Bronze.
    - b. Finish: Polished chrome plate.
    - c. Flow: **1.5 gpm**.
    - d. Mounting: **Concealed**.
    - e. Operation: Single-handle, **twist or rotate** control.
    - f. Antiscald Device: **Integral with shower valve**.
    - g. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.
    - h. Supply Connections: NPS 1/2.
  4. Shower Head:
    - a. Type: **Ball joint with arm and flange**.
    - b. Shower Head Material: ABS with chrome-plated finish.
    - c. Spray Pattern: **Adjustable**.
    - d. Volume Control: **Lever Handle**.
    - e. Flow: **2.0 gpm**.
  5. Mounting locations as indicated on Contract Drawings.
  6. Shower drain shall be floor drain with 2" outlet as specified in Section 221319 "Sanitary Waste Piping Specialties."
- D. Shower (ADA) SH-3:
1. Complete Shower Valve and Shower Head Package: Bradley 1C-HD-B1-LHV-B24-DV, or approved equal by Symmons or Leonard.
  2. Description: Single-handle, pressure-balance shower valve with hot- and cold-water indicators, check stops, diverter valve, shower head, and hand shower.
  3. Shower Valve:
    - a. Body Material: Bronze.
    - b. Finish: Polished chrome plate.

- c. Flow: **1.5 gpm.**
    - d. Mounting: **Concealed.**
    - e. Operation: Single-handle, **twist or rotate** control.
    - f. Antiscald Device: **Integral with shower valve.**
    - g. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.
    - h. Supply Connections: NPS 1/2.
  - 4. Diverter Valve:
    - a. Body Material: Bronze.
    - b. Finish: Polished chrome plate.
    - c. Mounting: **Concealed.**
    - d. Operation: Single-handle, **twist or rotate** control.
  - 5. Shower Head:
    - a. Type: **Ball joint with arm and flange.**
    - b. Shower Head Material: ABS with chrome-plated finish.
    - c. Spray Pattern: **Adjustable**
    - d. Integral Volume Control: **Lever Handle**
    - e. Flow: **2.0 gpm.**
  - 6. Hand Shower:
    - a. Type: **Hand spray with non-positive push button shut-off.**
    - b. Spray Pattern: **Fixed.**
    - c. Integral Volume Control: **Not required.**
    - d. Flow: **2.0 gpm.**
    - e. Features: Double check valve backflow preventer, 60" braided stainless steel flexible hose, 24" glide rail, supply elbow and flange.
  - 7. Mounting locations as indicated on Contract Drawings.
  - 8. Shower drain shall be floor drain with 2" outlet as specified in Section 221319 "Sanitary Waste Piping Specialties."
- E. Shower/Tub (Standard – Mock Apartment) SH-4:
- 1. Complete Shower Valve and Shower Head Package: Bradley 1C-HD-B1-LHV-DJ, or approved equal by Symmons or Leonard.
  - 2. Description: Single-handle, pressure-balance shower valve with hot- and cold-water indicators, check stops, diverter valve, shower head, and hand shower.
  - 3. Shower Valve:
    - a. Body Material: Bronze.
    - b. Finish: Polished chrome plate.
    - c. Flow: **1.5 gpm.**
    - d. Mounting: **Concealed.**
    - e. Operation: Single-handle, **twist or rotate** control.
    - f. Antiscald Device: **Integral with shower valve.**
    - g. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.
    - h. Supply Connections: NPS 1/2.
  - 4. Shower Head:
    - a. Type: **Ball joint with arm and flange.**
    - b. Shower Head Material: ABS with chrome-plated finish.
    - c. Spray Pattern: **Adjustable**
    - d. Integral Volume Control: **Lever Handle**
    - e. Flow: **2.0 gpm.**
  - 5. Tub:
    - a. Body Material: Steel or Cast Iron
    - b. Finish: Enamel
    - c. Mounting: Alcove.

- d. Outlet: Provide shower/tub drain with capped outlet.
- 6. Shower/Tub drain shall be capped.

## **2.2 GROUT**

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine roughing-in of water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before shower installation.
- B. Examine walls and floors for suitable conditions where showers will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Shower units shall be constructed by General Contractor.
- B. Assemble shower components according to manufacturers' written instructions.
- C. Install showers level and plumb according to roughing-in details.
- D. Install water-supply piping to each supply to each shower faucet.
- E. Seal joints between shower components and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Sealant color shall be clear. Comply with sealant requirements specified in Section 079200 "Joint Sealants."
- F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheons requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

### **3.3 CONNECTIONS**

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with traps and soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

### **3.4 ADJUSTING**

- A. Operate and adjust showers and controls. Replace damaged and malfunctioning showers, fittings, and controls.

### **3.5 CLEANING AND PROTECTION**

- A. After completing installation of showers, inspect and repair damaged finishes.
- B. Clean shower components with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed fixtures and fittings.
- D. Do not allow use of showers for temporary facilities unless approved in writing by Owner.

**END OF SECTION**



**SECTION 22 4500  
EMERGENCY PLUMBING FIXTURES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Combination units.
  - 2. Thermostatic mixing valves.

**1.3 DEFINITIONS**

- A. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply, and piped drain where indicated.
- B. Tepid: Water whose temperature is 60F minimum to 100F maximum.

**1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated. Include flow rates and capacities, furnished specialties, and accessories.

**1.5 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For emergency plumbing fixtures to include in operation and maintenance manuals.
- B. Provide final testing information on manufacturer's testing form.

**PART 2 - PRODUCTS**

**2.1 PERFORMANCE REQUIREMENTS**

- A. Comply with ANSI/ISEA Z358.1 - 2014.
- B. NSF Standard: Comply with NSF 61 and NSF 372, for fixture materials that will be in contact with potable water.

**2.2 COMBINATION UNITS**

- A. Standard, Plumbed Emergency Shower with Eyewash Combination Units, ESH-1:
  - 1. Bradley S19314DCFW or approved equal by Guardian or Speakman.
  - 2. Piping:
    - a. Material: **Galvanized steel.**
    - b. Unit Drain: Outlet at back or side 6" above finished floor.
  - 3. Shower:
    - a. Capacity: Not less than 20 gpm for at least 15 minutes at 30 psi.
    - b. Supply Piping: NPS 1 with flow regulator and stay-open control valve.
    - c. Control-Valve Actuator: **Pull rod with handle.**
    - d. Shower Head: 3-inch-minimum diameter, **plastic.**
    - e. Mounting: Pedestal.
  - 4. Eyewash Unit:
    - a. Capacity: Not less than 0.4 gpm for at least 15 minutes at 30 psi.
    - b. Supply Piping: NPS 1/2 with flow regulator and stay-open control valve.
    - c. Control-Valve Actuator: Paddle and Foot Pedal shall both be provided.
    - d. Spray-Head Assembly: Two receptor-mounted soft-flow angled spray heads with covers and spray ring.
    - e. Receptor: **Stainless-steel** bowl & hinged dust cover.
    - f. Mounting: Attached to shower pedestal.

## 2.3 THERMOSTATIC MIXING VALVES

- A. Combination Units:
  - 1. Bradley S19-2100- RS EFX25, or approved equal by Guardian or Speakman. Mixing valve manufacturer shall be the same as Combination Unit manufacturer.
  - 2. Description: Thermostatic mixing valve with inlet screwdriver check stops, outlet thermometer and low temperature adjustment range, and recessed stainless steel cabinet.
    - a. Thermostatic Mixing Valve: Designed to provide **85 deg F** tepid, potable water at emergency plumbing fixtures, to maintain temperature at plus or minus **5 deg F** throughout required 15-minute test period, and to continue cold-water flow in case of unit failure, with union connections, controls, metal piping, and corrosion-resistant enclosure.
    - b. Supply Connections: For hot and cold water.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in for water **and waste** piping systems to verify actual locations of piping connections before plumbed emergency plumbing fixture installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION OF EMERGENCY PLUMBING FIXTURE INSTALLATION

- A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.
- B. Install fixtures level and plumb.
- C. Fasten fixtures to substrate.
- D. Anchor vertical columns of Combination Units to wall with standoff brackets at 45° angle.
- E. Install Thermostatic Mixing Valves at 60" above finished floor to center of cabinet.
- F. Install shutoff valves in water-supply piping to fixtures, to facilitate maintenance of the equipment. Use ball valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Comply with requirements for valves specified in Section 220523 "General Duty Valves for Plumbing Piping".
- G. Install dielectric fitting in supply piping to emergency equipment if piping and equipment connections are made of different metals. Comply with requirements for dielectric fittings specified in Section 221116 "Domestic Water Piping."
- H. Install trap and waste piping on drain outlet of emergency equipment receptors that are indicated to be directly connected to drainage system. Comply with requirements for waste piping specified in Section 221316 "Sanitary Waste and Vent Piping."
- I. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

### 3.3 CONNECTIONS

- A. Connect hot- and cold-water-supply piping to hot- and cold-water, water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures. Comply with requirements for hot- and cold-water piping specified in Section 221116 "Domestic Water Piping."
- B. Directly connect emergency plumbing fixture receptors with trapped drain outlet to sanitary waste and vent piping. Comply with requirements for waste piping specified in Section 221316 "Sanitary Waste and Vent Piping."

- C. Plumbing Contractor shall install 1-1/4" schedule 40 PVC drain pipe to drain outlet of Combination Units with (2) 90-degree bends, to direct drainage to front of unit and into floor drain.
- D. Where installing piping adjacent to emergency plumbing fixtures, allow space for service and maintenance of fixtures.

**3.4 IDENTIFICATION**

- A. Install equipment nameplates or equipment markers on emergency plumbing fixtures and equipment and equipment signs on water-tempering equipment. Comply with requirements for identification materials specified in Section 220553 "Identification for Plumbing Piping and Equipment."

**3.5 FIELD QUALITY CONTROL**

- A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities.
- B. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection.
  - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: Activate units to confirm proper unit operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Certify performance of emergency plumbing fixtures by independent testing organization acceptable to authorities having jurisdiction.
- D. Provide Owner with shower tester.
- E. Emergency plumbing fixtures and water-tempering equipment will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.

**3.6 ADJUSTING**

- A. Adjust or replace fixture flow regulators for proper flow.
- B. Adjust equipment temperature settings.

**END OF SECTION**

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**SECTION 22 4716  
PRESSURE WATER COOLERS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section includes pressure water coolers and related components.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of pressure water cooler.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

**1.4 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For pressure water coolers to include in maintenance manuals.

**1.5 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Filter Cartridges: Equal to 10 percent of quantity installed for each type and size indicated, but no fewer than 1 of each.

**PART 2 - PRODUCTS**

**2.1 PRESSURE WATER COOLERS**

- A. Pressure Water Cooler (Dual Height) EWC-1: Flush to wall.
  - 1. Elkay LVRGRTL8WSK, or approved equal by Halsey Taylor or Oasis.
  - 2. Standards:
    - a. Comply with NSF 61 Annex G.
  - 3. Features: Dual height, vandal resistant, stainless steel anti-splash receptor, in-line 'Y' strainer, wall hanger.
  - 4. Cabinet: All stainless steel.
  - 5. Bubbler: One, with anti-squirt dual stream and adjustable stream regulator, located on deck.
  - 6. Control: Stainless Steel Push Controls on front.
  - 7. Bottle Filler: Hands free electronic sensor control.
  - 8. Drain: Grid with NPS 1-1/2 tailpiece.
  - 9. Supply: NPS 3/8. Wheel handle lead free stop valve shall be McGuire LF175 or approved equal by Zurn or Brasscraft.
  - 10. Waste Fitting: PVC P-trap.
  - 11. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards, with capacity sized for unit peak flow rate.
  - 12. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.
    - a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 13. Capacities and Characteristics:

- a. Cooled Water: 8 gph.
- b. Ambient-Air Temperature: 90 deg F.
- c. Inlet-Water Temperature: 80 deg F.
- d. Cooled-Water Temperature: 50 deg F.
- e. Electrical Characteristics:
  - 1) Volts: 115-V ac.
  - 2) Phase: Single.
  - 3) Hertz: 60.

## 2.2 SUPPORTS

- A. Water Cooler Carrier:
  - 1. Chair carrier with steel upright support legs, backing plates shall be Zurn Z-1225, or approved equal by J.R. Smith or Watts

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.
- B. Examine walls and floors for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.
- B. Plumbing Contractor should note that spout should be set at height as shown on the drawings.
- C. The Plumbing Contractor shall furnish the electrical receptacle rough-in dimensions to the Electrical Contractor to provide for a concealed electrical service to the unit.
- D. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.
- E. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 220523 "General-Duty Valves for Plumbing Piping".
- F. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
- G. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping".
- H. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Sealant color shall be clear. Comply with sealant requirements specified in Section 079200 "Joint Sealants".

### 3.3 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Install ball shutoff valve on water supply to each fixture. **Install valve upstream from filter for water cooler.** Comply with valve requirements specified in Section 220523 "General-Duty Valves for Plumbing Piping".
- D. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

**3.4 ADJUSTING**

- A. Adjust fixture flow regulators for proper flow and stream height.
- B. Adjust pressure water-cooler temperature settings.

**3.5 CLEANING**

- A. After installing fixture, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.
- C. Provide protective covering for installed fixtures.
- D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

**END OF SECTION**

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**SECTION 23 0500  
BASIC HVAC REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 CONTENTS**

- A. See HVAC Table of Contents.

**1.3 CODES AND STANDARDS**

- A. Contractor shall install all work and fired and unfired pressure vessels and their safety devices in accordance with the requirements of the latest edition of the Codes and Standards.
- B. Building Codes:
  - 1. North Carolina State Building Code, Latest Edition and Revisions (NCSBC).
  - 2. North Carolina State Boiler Inspection Law Rules and Regulations, Latest Edition and Revisions.
  - 3. National Fire Protection Association No. 70, 90A, 91, and any other applicable sections.
- C. Industry Standards:
  - 1. Underwriter's Laboratories, Inc. Standards and approved listings (UL)
  - 2. Electrical Testing Laboratories Standards (ETL)
  - 3. American National Standards Institute (ANSI)
  - 4. American Society for Testing Materials Standards (ASTM)
  - 5. Canadian Standards Association (CSA)

**1.4 SCOPE OF WORK**

- A. The Contractor shall provide labor and materials required for a complete system ready for operation as shown on the drawings and hereinafter specified. This includes all equipment, ductwork, necessary plumbing, and all other services necessary whether they are specifically mentioned herein or not. The entire installation shall be installed in a first-class, neat, professional manner to the satisfaction of the Engineer and shall conform to all applicable codes and laws.

**1.5 GENERAL**

- A. Equipment and Materials shall be new and shall bear the manufacturer's name, trade name, and UL label in every case where a standard has been established for the particular material. The equipment to be furnished under this specification shall be essentially the standard product of manufacturers regularly engaged in the production of the required type of equipment and shall be the manufacturer's latest approved design.
- B. Equipment and Materials of the same general type shall be of the same make throughout the work to provide uniform appearance, operation, and maintenance.
- C. Conditions shall be checked at the building before placing orders for apparatus and such apparatus shall be of such dimensions as to fit the spaces allotted. The Heating and Air Conditioning Contractor shall not scale mechanical plans, but rather refer to architectural plans for dimensions.
- D. Verify existing conditions of all underground elements and make reasonable efforts to protect any unknown underground elements. Notify the Owner immediately if unknown elements are discovered that would necessitate modification to the proposed design. The Heating and Air Conditioning Contractor shall have all existing utilities located by a third-party locating service prior to excavation.
- E. Equipment and Materials shall be delivered to the site and stored in original containers tightly covered and protected against dirt, water and chemical or mechanical injury and theft. At the completion of the work, fixtures, equipment, and materials shall be cleaned and polished thoroughly and turned over to the OWNER in a condition satisfactory to the A/E. Damage or

defects, developing before acceptance of the work shall be corrected at the CONTRACTOR's expense.

- F. The Contractor shall warranty the entire heating and air conditioning system subject to the General Conditions of these specifications and as further required in individual Sections.

#### **1.6 SUBMITTAL DATA AND SHOP DRAWINGS**

- A. The Contractor shall submit in accordance with Division 01 General Requirements and each Section of Division 23 a list of materials and the manufacturer to be used on this project. They shall submit multiple hard copies or electronic copies of submittal data for the Engineer's use in approving materials and equipment. One hard or electronic copy will be returned. It is requested that all submittal data be sent to the A/E at one time. Unless special consideration is given, none of the submittal data will be checked until it has all been received by the A/E. Where called for, the Contractor shall submit multiple hard copy or electronic sets of shop drawings showing the detailed arrangement or connections that are shown schematically on the drawings. Data certified for the specified project and indicated manufacturer, type, or size, capacity, etc., shall be submitted for the systems, equipment, etc. as noted in each Division 23 Section.

#### **1.7 APPROVAL OF EQUIPMENT, MATERIALS, ETC.**

- A. Manufacturers listed are to establish a standard of quality. All materials and equipment which are essential and have not been specified or shown shall be new and of the highest grade and quality, free from defect or other imperfections. Approval of equipment will not relieve the Contractor of compliance with the specifications even if such approval is made in writing, unless the attention of the Engineer is called to the non-complying features by letter accompanying the submittal data. Approval of submittal data by the Architect/Engineer shall not be construed as a complete check of approval of detailed dimensions, weights, gauges, and similar details with the proposed articles. The conformance with the necessary coordination between the various other contractors and suppliers shall be solely the responsibility of the Contractor.

#### **1.8 DRAWINGS AND SPECIFICATIONS**

- A. The drawings and specifications are complementary each to the other, and what may be called for by one shall be as binding as if called for by both.
- B. The drawings accompanying these specifications indicate diagrammatically the general location of the ducts, piping, and equipment and do not show all offsets, supports, fittings, bolts, connections, etc., required for a complete system. While the drawings are to be followed as closely as possible, if it is found necessary to change the location of same to accommodate the conditions at the building, such changes shall be made without additional cost to the Owner, and as directed by the Architect/Engineer. Any detail which is omitted, and which is necessary for the proper operation of any system included under the contract, shall be supplied and installed by the Contractor without extra cost to the Owner. All pipes and ducts shall be run as high as possible to maintain ceiling and head clearance. All equipment shall be installed in such a manner as to allow proper maintenance access.
- C. It shall be understood that where the words "furnish," "provide," and/or "install" are used, it is intended that this CONTRACTOR shall purchase and install completely all material necessary and required for this particular item, system, equipment, etc.
- D. Any omission from either the drawings or the specifications are unintentional, and it shall be the responsibility of the CONTRACTOR to call to the attention of the A/E any pertinent omissions before submitting a bid. Complete and working systems are required, whether every small item of material is shown and specified or not.

#### **1.9 COORDINATION OF WORK**

- A. It is understood and agreed that by submitting a bid, the CONTRACTOR has, by careful examination, satisfied himself as to the nature and location of the work, the conformation of the ground, the character, quality and quantity of the materials to be encountered, the general and local conditions and all other matters which can and may affect the work under this contract. The CONTRACTOR shall be held responsible for visiting the site and thoroughly familiarizing himself

with the existing conditions and also any contractual requirements as may be set forth in the other divisions of these specifications. No extras will be considered because of additional work necessitated by obvious job conditions that are not indicated on the drawings.

**PART 2 - PRODUCTS (Not Used)**

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Contractor shall cooperate with the contractors of other trades and shall install his work as fast as the progress of the balance of the work will permit.
- B. All debris resulting from heating and air conditioning work shall be removed from the premises daily or as directed by the Architect/Engineer. Trash and rubbish shall not be allowed to accumulate either within or outside the building. Materials and debris, which in the opinion of the Engineer cannot practicably be removed from the site the same day, may be temporarily stacked or stored in a designated location on the site as directed by the Architect/Engineer.
- C. Manufacturer's directions shall be followed completely in the delivery, storage, protection, and installation of all equipment and materials. The CONTRACTOR shall promptly notify the A/E, in writing, of any conflicts between any requirements of the Contract Documents and the manufacturer's directions and shall obtain the A/E's written instructions before proceeding with the work. Should the CONTRACTOR perform any work that does not comply with the manufacturer's instructions, recommendations, or requirements; it shall be corrected at the direction of the A/E at no additional cost to the Owner.
- D. Guards shall be provided for all moving equipment, motor couplings, pump shafts, belt drives and similar exposed reciprocating or rotating components.

**3.2 ELECTRICAL**

- A. Electrical circuit sizes are based on capacities of the drawings and it shall be the responsibility of the Contractor to change any and all electrical work in order to fit mechanical equipment. The Contractor shall coordinate to assure that all equipment is properly connected and shall check wiring prior to starting units. Any damage to units resulting from improper wiring or connections shall be the responsibility of Contractor. Flexible electrical conduits shall be 18 inches in length maximum.
- B. All electrical work shall be installed in accordance with codes having jurisdiction and the Electrical Division, Division 26, of these specifications.
- C. All power wiring and associated conduit shall be provided to HVAC equipment by the Electrical Contractor. The HVAC Contractor shall furnish all motor starters, disconnect switches, and combination starters for HVAC equipment and turn them over to the Electrical Contractor for installation. Variable speed drives for HVAC equipment shall be furnished by the Controls Contractor and turned over to the Electrical Contractor for installation. All final power wiring connections to HVAC equipment shall be made by the HVAC Contractor from slack wire left by the Electrical Contractor. Refer to the Contract Drawings for division responsibility regarding electrical requirements.
- D. Provide all control wiring, in conduit, required to satisfactorily control all HVAC equipment. Furnish and wire all control devices such as thermostats, switches, relays and any other devices necessary to control the equipment furnished in this section.
- E. HVAC Contractor shall provide power wiring and conduit to all damper and valve actuators.
- F. Duct mounted smoke detectors shall be furnished by the Electrical Contractor and installed in duct work by the HVAC Contractor. Wiring to the fire alarm system shall be provided by the Electrical Contractor.

**3.3 OPENINGS**

- A. The Contractor shall furnish all blockouts, sleeves, and openings required for his work. Sleeves for piping, etc., shall be in accordance with Section 230517 "Sleeves and Sleeve Seals for HVAC Piping." Specifically inform as to the correct size and location of openings and sleeves to insure

that they shall be cast in their proper location. Sleeves and duct opening frames shall be furnished and installed by the Contractor. Failure to indicate such openings in time to avoid delaying the project shall result in the Contractor providing all cutting and repairing at their own expense. Repairing shall include sealing tight around pipe sleeves and duct frames in a neat and professional manner and in accordance with the "Cutting and Patching" section of this specification.

- B. All penetrations in rated floors, firewalls and any other rated separations shall be protected using a through-penetration firestopping method with an "F" rating equivalent to the rating of the membrane being penetrated for particular piping materials used and membrane construction type. Floor penetrations shall additionally have a "T" rating equivalent to the rating of the floor being penetrated. Through-penetration firestop systems shall be installed and tested in accordance with ASTM E814 or UL 1479.
- C. Through-penetration firestop details indicated on the drawings are suggestive only. Actual details to be used shall be submitted.

### **3.4 CUTTING AND PATCHING**

- A. The Contractor shall do all cutting and patching necessary to install all equipment as required under their contract in accordance with the General Conditions of these specifications and shall re-establish all finishes where cutting and patching occur to their original condition. All cutting of the structure, where unavoidable, must be approved by the Architect/Engineer and be done by not this Contractor, but shall be paid for by this Contractor.

### **3.5 EXCAVATION, TRENCHING AND BACKFILL**

- A. The Contractor shall perform all excavation and backfilling required for the installation of this work or whatever substance encountered, to the depths indicated and required in accordance with this section and Division 31 of these specifications. During excavation, material suitable for backfilling shall be piled in an orderly manner a sufficient distance from banks to avoid overloading and to prevent cave-ins. Provide adequate support of sidewalls for protection of the work and personnel and as required by regulation of the NC State Dept. of Labor and US Department of Labor, Occupational Safety and Health Administration, Occupational and Safety and Health Standards.
- B. Extreme caution shall be exercised in advance to avoid damage to existing utilities and structures. All existing utilities and structures shall be protected from damage and, if damaged, shall be repaired by this Contractor at their own expense. Should utility lines be encountered within the area of operations, the Contractor shall notify the Architect in ample time for necessary measures to be taken to prevent interruption of service.

### **3.6 STARTUP**

- A. See individual Sections for additional requirements for systems, equipment, etc.
- B. Air Handling Units: Do not operate AHU's for any reason, temporary or permanent, without Architect/Engineer's approval. Prior to operation the following shall be complete and verified:
  1. Clean all new ductwork.
  2. Clean filters in place.
  3. Bearings lubricated.
  4. Condensate drain piping properly installed with trap.
  5. Piping inspected, leak tested, and insulated.
  6. Belts aligned and tensioned.
  7. Shipping braces removed.
  8. Bearing set screws torqued.
  9. Fan operation tested under observation.
  10. Spaces served shall be free of construction contaminates ( : dust in the air), and all dust making activities shall be complete.
  11. Return air pathways – either ducted or plenum, shall be protected with some form of filter media.

**3.7 CERTIFICATES**

- A. At completion of the job, the Contractor shall have all applicable installations approved by the State Boiler Inspector. Furnish and install suitable frames having a removable glass cover for posting certificates of inspection furnished by the North Carolina Department of Labor Boiler Bureau.

**3.8 OPERATION AND MAINTNANCE DATA**

- A. Section 017800 for requirements for Project Closeout documentation.
- B. Contractor shall deliver one complete set of bookmarked manuals in electronic PDF format of all operation and maintenance manuals to the Owner through the Architect, two (2) weeks before the pre-final inspection is held. The manuals shall be bookmarked to a minimum of one level – ie: each major piece of equipment (chiller, boiler switchboard, water closet, water heater, etc.) or document category (warranties, parts list, contact information, etc.) The manuals shall be delivered by one of the following:
  - 1. USB Drive
  - 2. CD/DVD
  - 3. Downloadable file from FTP Site
- C. Manuals shall include the following (at a minimum):
  - 1. Index and page numbers
  - 2. Certificate of Final Acceptance
  - 3. Summary sheet of warranties with dates noted and a copy of all warranties
  - 4. List of all subcontractors and suppliers with names, addresses, and phone numbers
  - 5. Special Inspection Reports
  - 6. Certified Test and Balance Report
  - 7. Complete start-up, operation, and shutdown procedures for each system including sequence of events, locations of switches, emergency procedures, and any other critical items.
  - 8. Lubrication schedules and types of lubricants
  - 9. Complete set of all submittal data and current shop drawings (including 3rd party generated shop drawings) and equipment description showing all capacities and other operation conditions
  - 10. Equipment summary showing all capacities and ratings (HP, Tons, kW, filter size, etc.)

**3.9 PROJECT RECORD DRAWINGS**

- A. See individual Sections for additional requirements for systems, equipment, etc.
- B. Section 017800 for requirements for Project Record Documents.

**3.10 DEMONSTRATION AND TRAINING**

- A. See individual Sections for additional requirements for systems, equipment, etc.

**END OF SECTION**

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**SECTION 23 0513  
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.
- B. Work Included:
  - 1. All power wiring and associated conduit shall be provided to HVAC equipment by the Electrical Contractor. The HVAC Contractor shall furnish all motor starters, disconnect switches and combination starters for HVAC equipment and turn them over to the Electrical Contractor for installation. All final power wiring connections to HVAC equipment shall be made by the HVAC Contractor from slack wire left by the Electrical Contractor. Refer to the Contract Drawings for division responsibility regarding electrical requirements.
  - 2. Provide all control wiring, in conduit, required to satisfactorily control all equipment included in this section. Furnish and wire all control devices such as thermostats, switches, relays and any other devices necessary to control the equipment furnished in this section.
  - 3. HVAC Contractor shall provide power wiring and conduit to all damper and valve actuators.
  - 4. Duct mounted smoke detectors shall be furnished by the Electrical Contractor and installed in duct work by the HVAC Contractor. Wiring to the fire alarm system shall be provided by the Electrical Contractor.

**1.3 COORDINATION**

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
  - 1. Motor controllers.
  - 2. Torque, speed, and horsepower requirements of the load.
  - 3. Ratings and characteristics of supply circuit and required control sequence.
  - 4. Ambient and environmental conditions of installation location.

**PART 2 - PRODUCTS**

**2.1 GENERAL MOTOR REQUIREMENTS**

- A. Comply with NEMA MG 1 unless otherwise indicated.
- B. Comply with IEEE 841 for severe-duty motors.

**2.2 MOTOR CHARACTERISTICS**

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

**2.3 POLYPHASE MOTORS**

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Premium efficient, as defined in NEMA MG 1.

- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
  - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
  - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F, unless otherwise indicated.
- J. Code Letter Designation:
  - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
  - 2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

#### **2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS**

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
  - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.
  - 2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
  - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
  - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

#### **2.5 SINGLE-PHASE MOTORS**

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
  - 1. Permanent-split capacitor.
  - 2. Split phase.
  - 3. Capacitor start, inductor run.
  - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine areas to receive field-installed motors for compliance with requirements, installation tolerances, and other conditions affecting performance.



- B. Examine roughing-in of conduit systems to verify actual locations of conduit connections before motor installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.2 MOTOR INSTALLATION**

- A. Anchor each motor assembly to base, adjustable rails, or other support, arranged and sized according to manufacturer's written instructions. Attach by bolting. Level and align with load transfer link.
- B. Comply with mounting and anchoring requirements specified in Division 23 Section "Vibration Controls for HVAC."
- C. Equipment overcurrent protection and conductors in the electrical contract shall be sized to accommodate most major brands of HVAC equipment. If the Contractor chooses to use an item of equipment that exceeds the capacity of the electrical overcurrent protection and conductors, or requires multiple circuits, the Contractor shall be responsible for any additional cost required to increase the size of the overcurrent protection and conductors or provide the additional circuits and disconnects at no additional cost to the Owner or Electrical Contractor. He shall also coordinate this work with the Electrical Contractor to assure proper electrical service to the equipment.

**3.3 FIELD QUALITY CONTROL**

- A. Prepare for acceptance tests as follows:
  - 1. Run each motor with its controller. Demonstrate correct rotation, alignment, and speed at motor design load.
  - 2. Test interlocks and control features for proper operation.
  - 3. Verify that current in each phase is within nameplate rating.

**3.4 ADJUSTING**

- A. Align motors, bases, shafts, pulleys and belts. Tension belts according to manufacturer's written instructions.

**3.5 CLEANING**

- A. After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean motors, on completion of installation, according to manufacturer's written instructions.

**END OF SECTION**

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**SECTION 23 0517**  
**SLEEVES AND SLEEVE SEALS FOR HVAC PIPING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Sleeves.
  - 2. Sleeve-seal systems.
  - 3. Grout.
  - 4. Silicone sealants.

**PART 2 - PRODUCTS**

**2.1 SLEEVES**

- A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop collar.
- B. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, with plain ends and integral welded waterstop collar.

**2.2 SLEEVE-SEAL SYSTEMS**

- A. Description:
  - 1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
  - 2. Designed to form a hydrostatic seal of 20-psig.
  - 3. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size.
  - 4. Pressure Plates: Composite plastic.
  - 5. Connecting Bolts and Nuts: Stainless steel, Type 316, of length required to secure pressure plates to sealing elements.

**2.3 GROUT**

- A. Description: Nonshrink, recommended for interior and exterior sealing openings in nonfire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

**2.4 SILICONE SEALANTS**

- A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C 920, Type S, Grade NS, Class 25, use NT.
- B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.

**PART 3 - EXECUTION**

**3.1 SLEEVE INSTALLATION**

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  - 1. Cut sleeves to extend 2 inches minimum beyond both surfaces.
  - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  - 3. Using grout or silicone sealant, seal space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke-Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials.

### **3.2 SLEEVE-SEAL-SYSTEM INSTALLATION**

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal-system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

### **3.3 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:
  - 1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
- B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

### **3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE**

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  - 1. Exterior Concrete Walls Above Grade:
    - a. Steel pipe sleeves.
  - 2. Exterior Concrete Walls Below Grade:
    - a. Cast-iron pipe sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
  - 3. Concrete Slabs-on-Grade:
    - a. Cast-iron pipe sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
  - 4. Concrete Slabs Above Grade:
    - a. Steel pipe sleeves.
  - 5. Interior Partitions:
    - a. Steel pipe sleeves.

**END OF SECTION**

**SECTION 23 0518  
ESCUTCHEONS FOR HVAC PIPING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Escutcheons.
  - 2. Floor plates.

**PART 2 - PRODUCTS**

**2.1 ESCUTCHEONS**

- A. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.
- B. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed or exposed-rivet hinge; and spring-clip fasteners.

**2.2 FLOOR PLATES**

- A. Split Floor Plates: Steel with concealed hinge.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Install escutcheons for exposed piping penetrations of finished area walls, ceilings, and floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

**3.2 FIELD QUALITY CONTROL**

- A. Using new materials, replace broken and damaged escutcheons and floor plates.

**END OF SECTION**

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**SECTION 23 0529  
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Metal pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Metal framing systems.
  - 4. Thermal-hanger shield inserts.
  - 5. Fastener systems.
  - 6. Pipe stands.
  - 7. Equipment supports.
- B. Related Requirements:
  - 1. Structural drawings for structural-steel shapes, plates and fabricated equipment supports.
  - 2. Section 230549 "Vibration Controls for HVAC" for vibration isolation devices.
  - 3. Section 233113 "Metal Ducts" for duct hangers and supports.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Detail fabrication and assembly of trapeze hangers.
  - 2. Include design calculations for designing trapeze hangers.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Welding certificates.

**1.5 QUALITY ASSURANCE**

- A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code, Section IX.

**PART 2 - PRODUCTS**

**2.1 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Engage a qualified professional engineer in good standing to design equipment supports.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions as required.
  - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
  - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
  - 3. Design seismic-restraint hangers and supports for piping and equipment.

**2.2 METAL PIPE HANGERS AND SUPPORTS**

- A. Carbon-Steel Pipe Hangers and Supports:
  - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.

2. Galvanized Metallic Coatings: Hot-dip galvanized, or electro-galvanized.
  3. Nonmetallic Coatings: Plastic coated, or epoxy powder-coated.
  4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Stainless-Steel Pipe Hangers and Supports:
1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
- C. Copper Pipe and Tube Hangers:
1. Description: MSS SP-58, Types 1 through 58, copper-plated steel, or epoxy-coated steel, factory-fabricated components.
  2. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

### **2.3 TRAPEZE PIPE HANGERS**

- A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

### **2.4 METAL FRAMING SYSTEMS**

- A. MFMA Manufacturer Metal Framing Systems:
1. Description: Shop- or field-fabricated, pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
  2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
  3. Channels: Continuous slotted carbon-steel, stainless-steel, Type 304 or extruded-aluminum channel with inturned lips.
  4. Channel Width: Selected for applicable load criteria.
  5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
  6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel or stainless steel.
  7. Metallic Coating: Manufacturer's standard galvanized finish except nonmetallic coating for electrolytic protection where systems are in direct contact with copper tubing. No coating required if stainless steel.
- B. Non-MFMA Manufacturer Metal Framing Systems:
1. Description: Shop- or field-fabricated, pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
  2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
  3. Channels: Continuous slotted carbon-steel or stainless-steel channel with inturned lips.
  4. Channel Width: Select for applicable load criteria.
  5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
  6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel or stainless steel.
  7. Metallic Coating: Manufacturer's standard galvanized finish except nonmetallic coating for electrolytic protection where systems are in direct contact with copper tubing. No coating required if stainless steel.

### **2.5 THERMAL-HANGER SHIELD INSERTS**

- A. Insulation-Insert Material for Hot Piping: Water-repellent-treated, ASTM C 533, Type I calcium silicate with 100-psi or ASTM C 552, Type II cellular glass with 100-psi minimum compressive strength.
- B. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.



- C. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- D. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

## **2.6 FASTENER SYSTEMS**

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type anchors for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
  - 1. Indoor Applications: Zinc-coated or stainless-steel.
  - 2. Outdoor Applications: Stainless steel.

## **2.7 PIPE STANDS**

- A. General Requirements for Pipe Stands: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support piping.
- B. Compact Pipe Stand:
  - 1. Description: Single base unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
  - 2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
  - 3. Hardware: Galvanized steel or polycarbonate.
- C. Low-Profile, Single Base, Single-Pipe Stand:
  - 1. Description: Single base with vertical and horizontal members, and pipe support.
  - 2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
  - 3. Vertical Members: Two, galvanized or stainless-steel, continuous-thread 1/2-inch rods.
  - 4. Horizontal Member: Adjustable horizontal, galvanized or stainless-steel pipe support channels.
  - 5. Pipe Supports: Strut clamps.
  - 6. Hardware: Galvanized or Stainless steel.

## **2.8 EQUIPMENT SUPPORTS**

- A. Equipment Support Stands
  - 1. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel or stainless-steel shapes as directed on the drawings.
  - 2. Base: Baseplates for attachment to concrete pad.
  - 3. Weight: To be included in submittal data.
  - 4. Coating: Painted if carbon-steel to prevent corrosion. No coating required if stainless steel.
  - 5. Height: 12 to 16 inches above finished grade. Contractor to coordinate final overall height of equipment and supports with all other trades and Owner prior to stand fabrication.
- B. All other equipment supports shall be welded, shop- or field-fabricated support frames made from structural carbon-steel or stainless-steel shapes.

## **2.9 MATERIALS**

- A. Aluminum: ASTM B 221.
- B. Carbon Steel: ASTM A 1011/A 1011M.
- C. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; galvanized.
- D. Stainless Steel: ASTM A 240/A 240M.
- E. Threaded Rods: Continuously threaded. Zinc-plated or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar materials as rods.

- F. Grout: ASTM C 1107/C 1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.

### **PART 3 - EXECUTION**

#### **3.1 APPLICATION**

- A. Comply with requirements in Section 230517 "Sleeves and Seals for HVAC Piping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

#### **3.2 HANGER AND SUPPORT INSTALLATION**

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
  - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled strut systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
  - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
  - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Stand Installation:
  - 1. Pipe Stand Types: Assemble components and mount on smooth roof surface.
- G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- H. Equipment Support Installation:
  - 1. Fabricate from welded-structural-steel shapes. Assemble components and mount on smooth. Install supports complete with necessary attachments, bolts, rods, nuts, washers, and other accessories.
- I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- J. Install lateral bracing with pipe hangers and supports to prevent swaying.
- K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

- L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- N. Insulated Piping:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
  - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 3. Shield Dimensions for Pipe: Not less than the following:
    - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    - b. NPS 4: 12 inches long and 0.06 inch thick.
    - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
  - 4. Pipes NPS 2 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
  - 5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### **3.3 EQUIPMENT SUPPORTS**

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### **3.4 METAL FABRICATIONS**

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

### **3.5 ADJUSTING**

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

### **3.6 PAINTING**

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Comply with requirements in Section 099113 "Exterior Painting" or Section 099123 "Interior Painting" per installed location for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780/A 780M.

### **3.7 HANGER AND SUPPORT SCHEDULE**

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile service or outdoor environment applications.
- G. Use copper-plated pipe hangers and similar copper or stainless-steel attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.
- J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
- K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
  - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
  - 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  - 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  - 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb.
    - b. Medium (MSS Type 32): 1500 lb.
    - c. Heavy (MSS Type 33): 3000 lb.
  13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
  15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
  2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
  3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
  4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
  5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
  6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
  7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
  8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include

auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

- a. Horizontal (MSS Type 54): Mounted horizontally.
  - b. Vertical (MSS Type 55): Mounted vertically.
  - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- P. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction after concrete is placed and completely cured.

**END OF SECTION**

**SECTION 23 0549**  
**VIBRATION CONTROLS FOR HVAC**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Elastomeric isolation pads.
  - 2. Elastomeric isolation mounts.
  - 3. Housed-spring isolators.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
  - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device type required.

**PART 2 - PRODUCTS**

**2.1 ELASTOMERIC ISOLATION PADS**

- A. The configuration and materials of elastomeric isolation pads depend on the equipment being supported. It is possible to have more than one type of elastomeric isolation pad on the same Project.
- B. Elastomeric Isolation Pads:
  - 1. Fabrication: Single or multiple layers of sufficient durometer (maximum of 50) stiffness for uniform loading over pad area.
  - 2. Size: Factory or field cut to match requirements of supported equipment.
  - 3. Pad Material: Neoprene.
  - 4. Surface Pattern: Ribbed or Waffle pattern on both sides.
  - 5. Load-bearing metal plates adhered to pads where required.

**2.2 ELASTOMERIC ISOLATION MOUNTS**

- A. Double-Deflection, Elastomeric Isolation Mounts:
  - 1. Mounting Plates:
    - a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.
    - b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.
  - 2. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

**2.3 HOUSED-SPRING ISOLATORS**

- A. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing:
  - 1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
  - 2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
  - 3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
  - 4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
  - 5. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.

- a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
- b. Top housing with attachment and leveling bolt, threaded mounting holes and internal leveling device.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine areas and equipment to receive vibration isolation control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 VIBRATION CONTROL DEVICE INSTALLATION**

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Division 03 specifications.
- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

#### **3.3 VIBRATION ISOLATION EQUIPMENT BASES INSTALLATION**

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Division 03 specifications.

**END OF SECTION**



**SECTION 23 0553**  
**IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Equipment and Access Panel and Door labels.
  - 2. Warning signs and labels.
  - 3. Pipe labels and painting.
  - 4. Duct labels.
  - 5. Warning tags.
  - 6. Accessible acoustical ceiling markers.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

**PART 2 - PRODUCTS**

**2.1 EQUIPMENT AND ACCESS PANEL AND DOOR LABELS**

- A. Metal Labels for Equipment:
  - 1. Material and Thickness: Stainless steel (0.025-inch), aluminum (0.032-inch), or anodized aluminum (0.032-inch) minimum thickness, and having predrilled or stamped holes for attachment hardware.
  - 2. Letter Color: Etched or stamped letters with White infill.
  - 3. Background Color: Black
  - 4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
  - 5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
  - 6. Fasteners: Stainless-steel self-tapping screws.
  - 7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment, Access Panels and Doors:
  - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick and having predrilled holes if necessary for attachment hardware.
  - 2. Letter Color: White.
  - 3. Background Color: Black.
  - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
  - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.
  - 6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for

greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

7. Fasteners: Stainless-steel self-tapping screws.
  8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content:
1. Equipment Number.
  2. Area(s) Served.
  3. Final Acceptance Date.
  4. Number and Size of Filters.
  5. Number and Size of Belts.
  6. Design Capacity including Airflow CFM, Cooling, Heating, etc.
  7. Labels on Access Panels and Doors shall have abbreviated terms and numbers corresponding to item accessed through panel or door.
- D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper, tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

## **2.2 WARNING SIGNS AND LABELS**

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick and having predrilled holes for attachment hardware.
- B. Letter Color: White.
- C. Background Color: Red.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- G. Fasteners: Stainless-steel self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information plus emergency notification instructions.

## **2.3 PIPE LABELS**

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
  1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
  2. Lettering Size: Size letters according to ASME A13.1 for piping.
- D. Lettering:
  1. Refrigerant: REF.
  2. Condensate: COND.

## **2.4 WARNING TAGS**

- A. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.
  - 1. Size: 3 by 5-1/4 inches minimum.
  - 2. Fasteners: Brass grommet and wire.
  - 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
  - 4. Color: Safety-yellow background with black lettering.

## **2.5 BELOW CEILING MARKERS**

- A. Description:
  - 1. Printed self-adhering tape label, 1-inch maximum in height, 1/4" high Arial font minimum lettering, black lettering on clear tape.

# **PART 3 - EXECUTION**

## **3.1 PREPARATION**

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

## **3.2 GENERAL INSTALLATION REQUIREMENTS**

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

## **3.3 EQUIPMENT, ACCESS PANEL, AND DOOR LABEL INSTALLATION**

- A. Install or permanently fasten labels on each major item of mechanical equipment or door.
- B. Locate equipment labels where accessible and visible.

## **3.4 PIPE LABEL INSTALLATION**

- A. All exposed mechanical piping and equipment in finished areas including ductwork, piping hangers, etc., shall be painted the same color as the adjacent ceiling and walls. Treat all items as necessary to receive paint.
- B. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
  - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 10 feet in areas of congested piping and equipment.
  - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- D. Pipe Label Color Schedule:
  - 1. Color-coded according to ASME A13.1.

**3.5 DAMPER MARKERS**

- A. Mark locations of manual balancing dampers by spray painting handles red.

**3.6 VALVE-TAG INSTALLATION**

- A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
  - 1. Valve-Tag Size and Shape:
    - a. Refrigerant: 1-1/2 inches, round.
  - 2. Valve-Tag Colors:
    - a. Refrigerant: Natural.

**3.7 VALVE-TAG SCHEDULE INSTALLATION**

- A. Valve-tag schedule shall also be mounted on wall under glass in a frame in each major mechanical room.

**3.8 WARNING-TAG INSTALLATION**

- A. Write required message on, and attach warning tags to, equipment and other items where required.

**3.9 BELOW CEILING MARKER INSTALLATION**

- A. Install label on accessible acoustical ceiling grid below equipment located above the ceiling.
- B. Thermostats, sensors, emergency buttons, etc. shall be labeled with their associated equipment tag number or system description.

**END OF SECTION**

**SECTION 23 0593**  
**TESTING, ADJUSTING, AND BALANCING FOR HVAC**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Scope: The scope of testing, adjusting and balancing for this project is limited to new equipment and devices only. All requirements described herein shall be followed as necessary to perform such work.
- B. Section Includes:
  - 1. Balancing Air Systems:
    - a. Constant-volume air systems.
  - 2. Testing, Adjusting, and Balancing Equipment:
    - a. Heat exchangers.
    - b. Motors.
    - c. Condensing units.
    - d. Heat-transfer coils.
  - 3. **Control system verification.**

**1.3 DEFINITIONS**

- A. AABC: Associated Air Balance Council.
- B. BAS: Building automation systems.
- C. NEBB: National Environmental Balancing Bureau.
- D. TAB: Testing, adjusting, and balancing.
- E. TABB: Testing, Adjusting, and Balancing Bureau.
- F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- G. TDH: Total dynamic head.

**1.4 PREINSTALLATION MEETINGS**

- A. TAB Conference: If requested by the Owner, conduct a TAB conference after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.
  - 1. Minimum Agenda Items:
    - a. The Contract Documents examination report.
    - b. The TAB plan.
    - c. Needs for coordination and cooperation of trades and subcontractors.
    - d. Proposed procedures for documentation and communication flow.

**1.5 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 45 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- D. System Readiness Checklists: Within 60 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article.

- E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.
- F. Certified TAB reports.
- G. Sample report forms.
- H. Instrument calibration reports, to include the following:
  - 1. Instrument type and make.
  - 2. Serial number.
  - 3. Application.
  - 4. Dates of use.
  - 5. Dates of calibration.

#### **1.6 QUALITY ASSURANCE**

- A. TAB Specialists Qualifications: Certified by AABC or NEBB.
  - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC or NEBB.
  - 2. TAB Technician: Employee of the TAB specialist and certified by AABC or NEBB as a TAB technician.
- B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements of AABC or NEBB.

#### **1.7 COORDINATION**

- A. Perform testing, adjusting, and balancing after all systems have been shown to be installed and satisfactorily in full working order in both heating and cooling.
- B. Perform testing, adjusting, and balancing after leakage and pressure testing for air and water systems have been satisfactorily completed.
- C. Notify Architect, Engineer, and Owner's Commissioning Agent 7 days in advance of each testing and balancing so that there is the opportunity to witness.

### **PART 2 - PRODUCTS (Not Applicable)**

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
- B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine equipment performance data including fan and pump curves.
  - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
  - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

- G. Examine test reports specified in individual system and equipment Sections.
- H. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
- I. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible, and their controls are connected and functioning.
- J. Examine operating safety interlocks and controls on HVAC equipment.
- K. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

### **3.2 PREPARATION**

- A. Prepare a TAB plan that includes the following:
  - 1. Equipment and systems to be tested.
  - 2. Strategies and step-by-step procedures for balancing the systems.
  - 3. Instrumentation to be used.
  - 4. Sample forms with specific identification for all equipment.
- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
  - 1. Airside:
    - a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
    - b. Duct systems are complete with terminals installed.
    - c. Volume, smoke, and fire dampers are open and functional.
    - d. Clean filters are installed.
    - e. Fans are operating, free of vibration, and rotating in correct direction.
    - f. Variable-frequency controllers' startup is complete and safeties are verified.
    - g. Automatic temperature-control systems are operational.
    - h. Ceilings are installed.
    - i. Windows and doors are installed.
    - j. Suitable access to balancing devices and equipment is provided.

### **3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING**

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
- B. Cut insulation, ducts, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
  - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
  - 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
  - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

### **3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS**

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

### **3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS**

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
  - 1. Measure total airflow.
    - a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
    - b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
    - c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
    - d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
  - 2. Measure fan static pressures as follows:
    - a. Measure static pressure directly at the fan outlet or through the flexible connection.
    - b. Measure static pressure directly at the fan inlet or through the flexible connection.
    - c. Measure static pressure across each component that makes up the air-handling system.
    - d. Report artificial loading of filters at the time static pressures are measured.
  - 3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
  - 4. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
  - 5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
  - 1. Measure airflow of submain and branch ducts.
  - 2. Adjust submain and branch duct volume dampers for specified airflow.
  - 3. Re-measure each submain and branch duct after all have been adjusted.
- C. Adjust air inlets and outlets for each space to indicated airflows.
  - 1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
  - 2. Measure inlets and outlets airflow.



3. Adjust each inlet and outlet for specified airflow.
  4. Re-measure each inlet and outlet after they have been adjusted.
- D. Verify final system conditions.
1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
  2. Re-measure and confirm that total airflow is within design.
  3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
  4. Mark all final settings.
  5. Test system in economizer mode. Verify proper operation and adjust if necessary.
  6. Measure and record all operating data.
  7. Record final fan-performance data.

### **3.6 PROCEDURES FOR CONDENSING UNITS**

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record fan and motor operating data.

### **3.7 CONTROLS VERIFICATION**

- A. In conjunction with system balancing, perform the following:
1. **Verify temperature control system is operating within the design limitations.**
  2. **Confirm that the sequences of operation are in compliance with Contract Documents.**
  3. **Verify that controllers are calibrated and function as intended.**
  4. **Verify that controller set points are as indicated.**
  5. **Verify the operation of lockout or interlock systems.**
  6. **Verify the operation of valve and damper actuators.**
  7. **Verify that controlled devices are properly installed and connected to correct controller.**
  8. **Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.**
  9. **Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.**
- B. **Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.**

### **3.8 TOLERANCES**

- A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
  1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
  2. Air Outlets and Inlets: Plus or minus 10 percent.
- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

### **3.9 PROGRESS REPORTING**

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: Prepare biweekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

### 3.10 FINAL REPORT

- A. General: Prepare a certified typewritten report in letter-quality font, in 3-ring binder; tabulate and divide the report into separate sections for tested systems and balanced systems.
  - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
  - 2. Include a list of instruments used for procedures, along with proof of calibration.
  - 3. Certify validity and accuracy of field data.
- B. Final Report Contents: In addition to certified field-report data, include the following:
  - 1. Fan curves.
  - 2. Manufacturers' test data.
  - 3. Field test reports prepared by system and equipment installers.
  - 4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.
- C. General Report Data: In addition to form titles and entries, include the following data:
  - 1. Title page.
  - 2. Name and address of the TAB specialist.
  - 3. Project name.
  - 4. Project location.
  - 5. Architect's name and address.
  - 6. Engineer's name and address.
  - 7. Contractor's name and address.
  - 8. Report date.
  - 9. Signature of TAB supervisor who certifies the report.
  - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
  - 11. Summary of contents including the following:
    - a. Indicated versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.
  - 12. Nomenclature sheets for each item of equipment.
  - 13. Data for terminal units, including manufacturer's name, type, size, and fittings.
  - 14. Notes to explain why certain final data in the body of reports vary from indicated values.
  - 15. Test conditions for fans performance forms including the following:
    - a. Settings for outdoor-, return-, and exhaust-air dampers.
    - b. Conditions of filters.
    - c. Cooling coil, wet- and dry-bulb conditions.
    - d. Face and bypass damper settings at coils.
    - e. Fan drive settings including settings and percentage of maximum pitch diameter.
    - f. Inlet vane settings for variable-air-volume systems.
    - g. Settings for supply-air, static-pressure controller.
    - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
  - 1. Quantities of outdoor, supply, return, and exhaust airflows.
  - 2. Duct, outlet, and inlet sizes.
  - 3. Terminal units.
  - 4. Balancing stations.
  - 5. Position of balancing devices.
- E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
  - 1. Unit Data:
    - a. Unit identification.

- b. Location.
- c. Make and type.
- d. Model number and unit size.
- e. Manufacturer's serial number.
- f. Unit arrangement and class.
- g. Discharge arrangement.
- h. Sheave make, size in inches, and bore.
- i. Center-to-center dimensions of sheave and amount of adjustments in inches.
- j. Number, make, and size of belts.
- k. Number, type, and size of filters.
- 2. Motor Data:
  - a. Motor make, and frame type and size.
  - b. Horsepower and rpm.
  - c. Volts, phase, and hertz.
  - d. Full-load amperage and service factor.
  - e. Sheave make, size in inches, and bore.
  - f. Center-to-center dimensions of sheave and amount of adjustments in inches.
- 3. Test Data (Indicated and Actual Values):
  - a. Total airflow rate in cfm.
  - b. Total system static pressure in inches wg.
  - c. Fan rpm.
  - d. Discharge static pressure in inches wg.
  - e. Filter static-pressure differential in inches wg.
  - f. Preheat-coil static-pressure differential in inches wg.
  - g. Cooling-coil static-pressure differential in inches wg.
  - h. Heating-coil static-pressure differential in inches wg.
  - i. Outdoor airflow in cfm.
  - j. Return airflow in cfm.
  - k. Outdoor-air damper position.
  - l. Return-air damper position.
  - m. Vortex damper position.
- F. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:
  - 1. Unit Data:
    - a. System identification.
    - b. Location.
    - c. Coil identification.
    - d. Capacity in Btu/h.
    - e. Number of stages.
    - f. Connected volts, phase, and hertz.
    - g. Rated amperage.
    - h. Airflow rate in cfm.
    - i. Face area in sq. ft..
    - j. Minimum face velocity in fpm.
  - 2. Test Data (Indicated and Actual Values):
    - a. Heat output in Btu/h.
    - b. Airflow rate in cfm.
    - c. Air velocity in fpm.
    - d. Entering-air temperature in deg F.
    - e. Leaving-air temperature in deg F.
    - f. Voltage at each connection.
    - g. Amperage for each phase.

- G. Fan Test Reports: For supply, return, and exhaust fans, include the following:
1. Fan Data:
    - a. System identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and size.
    - e. Manufacturer's serial number.
    - f. Arrangement and class.
    - g. Sheave make, size in inches, and bore.
    - h. Center-to-center dimensions of sheave and amount of adjustments in inches.
  2. Motor Data:
    - a. Motor make, and frame type and size.
    - b. Horsepower and rpm.
    - c. Volts, phase, and hertz.
    - d. Full-load amperage and service factor.
    - e. Sheave make, size in inches, and bore.
    - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
    - g. Number, make, and size of belts.
  3. Test Data (Indicated and Actual Values):
    - a. Total airflow rate in cfm.
    - b. Total system static pressure in inches wg.
    - c. Fan rpm.
    - d. Discharge static pressure in inches wg.
    - e. Suction static pressure in inches wg.
- H. Round and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
1. Report Data:
    - a. System and air-handling-unit number.
    - b. Location and zone.
    - c. Traverse air temperature in deg F.
    - d. Duct static pressure in inches wg.
    - e. Duct size in inches.
    - f. Duct area in sq. ft..
    - g. Indicated airflow rate in cfm.
    - h. Indicated velocity in fpm.
    - i. Actual airflow rate in cfm.
    - j. Actual average velocity in fpm.
    - k. Barometric pressure in psig.
- I. Air-Terminal-Device Reports:
1. Unit Data:
    - a. System and air-handling unit identification.
    - b. Location and zone.
    - c. Apparatus used for test.
    - d. Area served.
    - e. Make.
    - f. Number from system diagram.
    - g. Type and model number.
    - h. Size.
    - i. Effective area in sq. ft..
  2. Test Data (Indicated and Actual Values):
    - a. Airflow rate in cfm.
    - b. Air velocity in fpm.

- c. Preliminary airflow rate as needed in cfm.
  - d. Preliminary velocity as needed in fpm.
  - e. Final airflow rate in cfm.
  - f. Final velocity in fpm.
  - g. Space temperature in deg F.
- J. Compressor and Condenser Reports: For refrigerant side of unitary systems, stand-alone refrigerant compressors, air-cooled condensing units, or water-cooled condensing units, include the following:
  - 1. Unit Data: Include the following:
    - a. Unit identification.
    - b. Location.
    - c. Unit make and model number.
    - d. Manufacturer's compressor serial numbers.
    - e. Compressor make.
    - f. Compressor model and serial numbers.
    - g. Refrigerant weight in lb.
    - h. Low ambient temperature cutoff in deg F.
  - 2. Test Data: Include design and actual values for the following:
    - a. Inlet-duct static pressure in inches wg.
    - b. Outlet-duct static pressure in inches wg.
    - c. Entering-air, dry-bulb temperature in deg F.
    - d. Leaving-air, dry-bulb temperature in deg F.
    - k. Control settings.
    - n. High-pressure-cutout set point in psig.
    - o. Suction pressure in psig.
    - p. Suction temperature in deg F.
    - u. Voltage at each connection.
    - v. Amperage for each phase.
    - y. Number of fans.
    - z. Condenser fan rpm.
    - aa. Condenser fan airflow rate in cfm.
    - bb. Condenser fan motor make, frame size, rpm, and horsepower.
    - cc. Condenser fan motor voltage at each connection.
    - dd. Condenser fan motor amperage for each phase.
- K. Instrument Calibration Reports:
  - 1. Report Data:
    - a. Instrument type and make.
    - b. Serial number.
    - c. Application.
    - d. Dates of use.
    - e. Dates of calibration.

### **3.11 VERIFICATION OF TAB REPORT**

- A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of commissioning authority if requested.
- B. Commissioning authority may randomly select measurements, documented in the final report, to be rechecked if requested. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
- C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

- D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- E. If TAB work fails, proceed as follows:
  - 1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
  - 2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
  - 3. If the second verification also fails, the engineer of record may contact AABC Headquarters regarding the AABC National Performance Guaranty.
- F. Prepare test and inspection reports.

**3.12 ADDITIONAL TESTS**

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

**END OF SECTION**

**SECTION 23 0713  
DUCT INSULATION**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section includes insulating duct services.
- B. Related Sections:
  - 1. Section 230719 "HVAC Piping Insulation."

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
  - 3. Detail application of field-applied jackets.
  - 4. Detail application at linkages of control devices.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

**1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.
- B. Storage: Protect insulation from weather, moisture, and dirt.

**1.7 COORDINATION**

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for

installation of insulation and field-applied jackets and finishes and for space required for maintenance.

## **1.8 SCHEDULING**

- A. Schedule insulation application after testing systems. Insulation application may begin on segments that have satisfactory test results.

## **PART 2 - PRODUCTS**

### **2.1 INSULATION MATERIALS**

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket.
- F. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket.

### **2.2 ADHESIVES**

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
- D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

### **2.3 MASTICS**

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
  - 1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
  - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
  - 3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
  - 4. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
  - 1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
  - 2. Service Temperature Range: Minus 50 to plus 220 deg F.
  - 3. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
  - 4. Color: White.

### **2.4 LAGGING ADHESIVES**

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
  - 1. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
  - 2. Service Temperature Range: 0 to plus 180 deg F.



3. Color: White.

## 2.5 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
  1. Materials shall be compatible with insulation materials, jackets, and substrates.
  2. Fire- and water-resistant, flexible, elastomeric sealant.
  3. Service Temperature Range: Minus 40 to plus 250 deg F.
  4. Color: Aluminum.

## 2.6 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
  1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

## 2.7 TAPES

- A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
  1. Width: 3 inches.
  2. Thickness: 6.5 mils.
  3. Adhesion: 90 ounces force/inch in width.
  4. Elongation: 2 percent.
  5. Tensile Strength: 40 lbf/inch in width.
  6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

## 2.8 SECUREMENTS

- A. Insulation Pins and Hangers:
  1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch-diameter shank, length to suit depth of insulation indicated.
  2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
  3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
    - a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
    - b. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
    - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
  4. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
    - a. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
    - b. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
    - c. Adhesive-backed base with a peel-off protective cover.
  5. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

- a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

B. Wire: 0.062-inch soft-annealed, stainless steel.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  - 1. Verify that systems to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 PREPARATION**

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

#### **3.3 GENERAL INSTALLATION REQUIREMENTS**

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  - 3. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, tape, and seal patches similar to butt joints.

### 3.4 PENETRATIONS

- A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  - 4. Seal jacket to wall flashing with flashing sealant.
- B. Insulation Installation at Interior Floor, Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Floor, Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

### 3.5 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
  - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
  - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  - 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not overcompress insulation during installation.
    - e. Impale insulation over pins and attach speed washers.
    - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  - 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with tape. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface.

Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
  6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
  7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
- B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
  2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not overcompress insulation during installation.
    - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with tape. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
  5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
  6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

### 3.6 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
1. Indoor, concealed supply, return, and outdoor air.
  2. Indoor, exposed supply, return, exhaust, and outdoor air.

- B. Items Not Insulated:
  - 1. Fibrous-glass ducts.
  - 2. Metal ducts with duct liner.
  - 3. Factory-insulated flexible ducts.
  - 4. Factory-insulated plenums and casings.
  - 5. Flexible connectors.
  - 6. Vibration-control devices.
  - 7. Factory-insulated access panels and doors.

3.7 **INDOOR DUCT AND PLENUM INSULATION SCHEDULE**

- A. Concealed above ceiling, rectangular and round, supply, return, and outside-air duct insulation shall be the following:
  - 1. Mineral-Fiber Blanket: 2 inches thick and 1.0-lb/cu. ft. nominal density.
- B. Exposed in finished areas and in mechanical equipment rooms, rectangular and round, supply, return, exhaust, and outside-air duct insulation shall be the following:
  - 1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.

**END OF SECTION**

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**SECTION 23 0719  
HVAC PIPING INSULATION**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section includes insulating the following HVAC piping systems:
  - 1. Condensate drain piping.
  - 2. Refrigerant piping.
- B. Related Sections:
  - 1. Section 230713 "Duct Insulation."

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Detail insulation application at pipe expansion joints for each type of insulation.
  - 3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  - 4. Detail removable insulation at piping specialties.
  - 5. Detail application of field-applied jackets.
  - 6. Detail application at linkages of control devices.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

**1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.
- B. Protect insulation from weather, moisture, and dirt.

## **1.7 COORDINATION**

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

## **1.8 SCHEDULING**

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

## **PART 2 - PRODUCTS**

### **2.1 INSULATION MATERIALS**

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," and "Outdoor, Aboveground Piping Insulation Schedule," articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

### **2.2 ADHESIVES**

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
- C. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

### **2.3 SEALANTS**

- A. Joint Sealants:
  - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
- B. Metal Jacket Flashing Sealants:
  - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 2. Fire- and water-resistant, flexible, elastomeric sealant.
  - 3. Service Temperature Range: Minus 40 to plus 250 deg F.
  - 4. Color: Aluminum.
- C. PVC Jacket Flashing Sealants:
  - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 2. Fire- and water-resistant, flexible, elastomeric sealant.
  - 3. Service Temperature Range: Minus 40 to plus 250 deg F.
  - 4. Color: White.

### **2.4 CRUSH RESISTANT INSULATION CLAMPS**

- A. For all piping insulated with flexible elastomeric insulation, crush resistant insulation clamp assemblies shall be used at all pipe support locations including, but not limited to, hangers, supports and clamps.
- B. Crush resistant clamp shall be a factory-made insulation assembly with hard outer jacket, vibration absorbing rubber inner jacket, and closed cell elastomeric insulation.



- C. All metallic parts (clamp, hardware, etc) included with the clamp assembly shall be stainless steel or galvanized steel.
- D. The assembly shall be installed and sealed so that there is no interruption of the insulation envelope.

## 2.5 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
  - 1. Adhesive: As recommended by jacket material manufacturer.
  - 2. Color: White.
  - 3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- C. Metal Jacket:
  - 1. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
    - a. Sheet and roll stock ready for shop or field sizing.
    - b. Finish and thickness are indicated in field-applied jacket schedules.
    - c. Moisture Barrier for Indoor and Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
    - d. Factory-Fabricated Fitting Covers:
      - 1) Same material, finish, and thickness as jacket.
      - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
      - 3) Tee covers.
      - 4) Flange and union covers.
      - 5) End caps.
      - 6) Beveled collars.
      - 7) Valve covers.
      - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

## 2.6 TAPES

- A. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
  - 1. Width: 2 inches.
  - 2. Thickness: 6 mils.
  - 3. Adhesion: 64 ounces force/inch in width.
  - 4. Elongation: 500 percent.
  - 5. Tensile Strength: 18 lbf/inch in width.

## 2.7 SECUREMENTS

- A. Bands:
  - 1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 3/4 inch wide.
  - 2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide.
- B. Wire: 0.062-inch soft-annealed, stainless steel.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  - 1. Verify that systems to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
  - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 PREPARATION**

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### **3.3 GENERAL INSTALLATION REQUIREMENTS**

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and tape.
  - 3. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.

4. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
  1. Vibration-control devices.
  2. Testing agency labels and stamps.
  3. Nameplates and data plates.
  4. Manholes.
  5. Handholes.
  6. Cleanouts.

### 3.4 PENETRATIONS

- A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
  1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  4. Seal jacket to wall flashing with flashing sealant.
- B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
  1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- D. Insulation Installation at Floor Penetrations:
  1. Pipe: Install insulation continuously through floor penetrations and in accordance with drawings details.
  2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078400 "Firestopping."

### 3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles or in equipment manufacturers installation instructions.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
  1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
  2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt

each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
  6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. Install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

### **3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION**

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Use crush-resistant insulation assembly at all pipe supports, hangers, clamps, etc. to maintain insulation envelope.
- C. Insulation Installation on Pipe Flanges:
  1. Install pipe insulation to outer diameter of pipe flange.
  2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
  4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Pipe Fittings and Elbows:
  1. Install mitered sections of pipe insulation.
  2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- E. Insulation Installation on Valves and Pipe Specialties:
  1. Install preformed valve covers manufactured of same material as pipe insulation when available.
  2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.

3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### **3.7 FIELD-APPLIED JACKET INSTALLATION**

- A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.
  1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

### **3.8 PIPING INSULATION SCHEDULE, GENERAL**

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  1. Drainage piping located in crawl spaces.
  2. Underground piping.
  3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

### **3.9 INDOOR PIPING INSULATION SCHEDULE**

- A. Condensate and Equipment Drain Water below 60 Deg F:
  1. All Pipe Sizes: Insulation shall be:
    - a. Flexible Elastomeric: 1 inch thick.
- B. Refrigerant Suction, Liquid and Hot-Gas Piping:
  1. All Pipe Sizes: Insulation shall be the following:
    - a. Flexible Elastomeric: 1-1/2 inches thick.

### **3.10 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE**

- A. Refrigerant Suction, Liquid, and Hot-Gas Piping:
  1. All Pipe Sizes: Insulation shall be the following:
    - a. Flexible Elastomeric: 1-1/2 inches thick.

### **3.11 INDOOR, FIELD-APPLIED JACKET SCHEDULE**

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
  1. None.
- D. Piping, Exposed, Not in Mechanical Rooms:
  1. PVC: 30 mils thick.

### **3.12 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE**

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping:
  1. Aluminum, Corrugated: 0.032 inch thick.

### **END OF SECTION**

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**SECTION 23 0900  
INSTRUMENTATION AND CONTROL FOR HVAC**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

**1.2 DESCRIPTION OF WORK**

- A. Furnish and install a Direct Digital Control (DDC) Energy Management and Building Automation System (BAS) electric control system to fulfill the intent of the drawings and specifications.
- B. **Controls shall be DDC BACnet BAS connected to new building's Ethernet and fully incorporated into Brunswick Community College's existing BACnet Allerton central system on the Campus' on site computer in the Maintenance Office including all necessary integration, updating of system's graphics pages, software, etc. as necessary.**
- C. **As Alternate for proprietary system, provide the cost to add to the Base Bid for new DDC BAS control system to be DDC BACnet Allerton installed by Hoffman Building Technologies connecting to the new building's Ethernet and connecting to the existing Allerton controls on the Campus' on site computer in the Maintenance Office, including all necessary integration, updating of system's graphics pages, software, etc. as necessary.**
- D. The system shall include all necessary labor, BACnet-compliant hardware and software, electrical wiring, controllers, devices, and materials for a complete installed control system. The control system shall be erected, assembled, and installed by factory-trained mechanics regularly employed by the control manufacturer or manufacturer's authorized distributor as a subcontractor to the Heating and Air Conditioning Contractor. All equipment, unless specified to the contrary, shall be new and fully proportional and shall be the product of the control manufacturer.
- E. The control diagrams indicated on the drawings or specified herein show the intended sequences of operation of the various control systems and shall be followed as closely as practicable. All required devices and control schemes may not be shown on the drawings. It is the Contractor's responsibility to provide all devices and control schemes whether shown or not.
- F. Additional General Requirements for Controls:
  - 1. All wiring, conduit, and panels for all temperature controls.
  - 2. All interconnecting cables between supplied cabinets, application controllers, and input/output devices.
  - 3. Power required for controls shall be provided by the Controls Contractor from points coordinated with the Electrical Contractor.
  - 4. Perform all wiring in accordance with all local and national codes and Division 26 of these specifications.
  - 5. Surge transient protection shall be incorporated in the design of the system to protect electrical components in all system components as described below under "General Product Description."
  - 6. System modifications necessary to fine-tune sequences during commissioning of systems at no additional cost to the Owner.
  - 7. Mount control devices inside of a UL-listed steel enclosure panel, with hinged locking cover and key locking latch.
  - 8. Provide supervisory specialists and technicians at the job site to assist in all phases of system installation, startup, and commissioning.
  - 9. Provide a comprehensive operator and technician training program as described herein.
  - 10. Provide as-built documentation, operator's terminal software, diagrams, and all other associated project operational documentation (such as technical manuals) on approved media, the sum total of which accurately represents the final system.
- G. Wiring and Controls:

1. Control Contractor shall be responsible for the installation and wiring of temperature controls, control interlock wiring, electrical controls and devices in the temperature control system.

### 1.3 QUALITY ASSURANCE AND STANDARDS

- A. Materials and equipment shall be the cataloged products of manufacturers regularly engaged in production and installation of integrated control systems and shall be manufacturer's latest standard design that complies with the specification requirements.
- B. All products used in this project installation shall be new and currently being manufactured. This installation shall not be used as a test site for any new products. Spare parts shall be available for at least five years after completion of this contract.
- C. Install system using competent workmen who are fully trained in the installation of integrated control systems.
- D. Single source responsibility of Contractor shall be the complete installation and proper operation of the control system and shall include debugging and proper calibration of each component in the entire system.
- E. Contractor shall have an in-place support facility within 150 miles of the site with technical staff, spare parts inventory and all necessary test and diagnostic equipment.
- F. The Contractor and manufacturer representative shall support the installed system for a minimum of 1 year. The support shall provide full material warranty of controllers and 8 hours of on-site training.
- G. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Section 15, governing Radio Frequency Electromagnetic Interference and be so labeled.
- H. All BAS peer-to-peer network controllers, central system controllers and local user displays shall be UL Listed under Standard UL 916, category PAZX.
- I. Design and build all system components to be fault-tolerant.
  1. Satisfactory operation without damage at 110% and 85% of rated voltage and at plus 3-Hertz variation in line frequency.
  2. Static, transient and short-circuit protection on all inputs and outputs.
  3. Protect communication lines against incorrect wiring, static transients and induced magnetic interference.
  4. Network-connected devices to be A.C. coupled or equivalent or that any single device failure will not disrupt or halt network communication.
  5. All real time clocks and data file RAM to be battery-backed for a minimum 72 hours and include local and system low battery indication.
  6. All programs shall retain their memory for a minimum of 7 days upon loss of power.
- J. Reference Standards:
  1. The latest edition of the following standards and codes in effect and amended as of supplier's proposal date, and any applicable subsections thereof, shall govern design and selection of equipment and material supplied:
    - a. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
    - b. ANSI/ASHRAE Standard 135-2008, BACnet.
    - c. Uniform Building Code (UBC), including local amendments.
    - d. UL 916 Underwriters Laboratories Standard for Energy Management Equipment. Canada and the US.
    - e. National Electrical Code (NEC).
    - f. FCC Part 15, Subpart J, Class A.
    - g. EMC Directive 89/336/EEC (European CE Mark).
    - h. UL-864 UUKL listing for Smoke Controls for any equipment used in smoke control sequences.
  2. City, county, state, and federal regulations and codes in effect as of contract date.



3. Except as otherwise indicated, the system supplier shall secure and pay for all permits, inspections, and certifications required for his work, and arrange for necessary approvals by the governing authorities.
- K. Comply with NFPA 90A, Standard for Installation of Air Conditioning and Ventilating Systems.
- L. Provide wiring in accordance with NEC requirements and Division 26 of these Specifications.

#### **1.4 SUBMITTALS**

- A. Product Data: Submit copies of manufacturer's technical product data for each control device furnished. Indicate dimensions, capacities, performance, electrical characteristics, material finishes; also include installation and start-up instructions.
- B. Shop Drawings: Submit copies of shop drawings for each control system, containing at least the following information:
  1. The system supplier shall submit engineered drawings, control sequence, and bill of materials for approval.
  2. Drawings shall be submitted in the following standard sizes: 8.5" x 11"
  3. Drawings shall be available on digital media.
- C. System Documentation - Include the following in submittal package:
  1. System configuration diagrams in simplified block format.
  2. All input/output object listings and an alarm point summary listing.
  3. Electrical drawings that show all system internal and external connection points, terminal block layouts, and terminal identification.
  4. Complete bill of materials, valve schedule and damper schedule.
  5. Manufacturer's instructions and drawings for installation, maintenance, and operation of all purchased items.
  6. Overall system operation and maintenance instructions—including preventive maintenance and troubleshooting instructions.
  7. For all system elements—operator's workstation(s), building controller(s), application controllers, routers, and repeaters—provide BACnet Protocol Implementation Conformance Statements (PICS) as per ANSI/ASHRAE Standard 135-2001.
  8. Provide complete description and documentation of any proprietary (non-BACnet) services and/or objects used in the system.
  9. A list of all functions available and a sample of function block programming that shall be part of delivered system.
- D. Number of copies of Product Data and Shop Drawings shall be per Division 1 of these Specifications.
- E. Project Management: The vendor shall provide a detailed project design and installation schedule with time markings and details for hardware items and software development phases. Schedule shall show all the target dates for transmission of project information and documents, and shall indicate timing and dates for system installation, debugging, and commissioning.
- F. BACnet Device Object Naming Conventions:
  1. The BAS manufacturer's representative shall submit a BACnet Device Object Naming Convention Plan (DONCP) to the owner and consulting engineer during the submittal process. The plan must be approved by the owner and consulting engineer prior to implementation. It is the responsibility of the BAS contractor to coordinate the DONCP with the owner and consulting engineer.
  2. The DONCP shall be designed to eliminate any confusion between individual points in a facility/campus wide EMCS system. It will also be designed to allow for future expansion and consistency. Each device on a BACnet internetwork (including other manufacturer's devices) must have a unique device instance. This is a major consideration when adding to an existing system or interconnecting networks. Thorough and accessible site documentation is critical.

3. A consistent object (point) naming convention shall be used to facilitate familiarity and operational ease across an eventual large campus or inventory of facilities. The following section is designed as recommendations only. It is the responsibility of the BAS contractor to coordinate the DONCP with the owner and consulting engineer.
  - a. BACnet Addressing: Three types of addresses are important in any BACnet system: network numbers, media access control (MAC) addresses, and device instances. Each BACnet device has these addresses associated with it. Though all three can be thought of as addresses, they are all very different both in how they function and how they are assigned.
  - b. Network Numbers: Identifies the network to which a BACnet device belongs. Every network on a BACnet LAN has a unique numerical identifier—a network number. This network number is used by BACnet devices only; it does not rely on nor does it affect any other network protocols. LANs connected by a router must have different network numbers. No interconnected BACnet networks can have the same network number. Network number range is 1–65,534, for a maximum of 65,534 interconnected BACnet networks.
  - c. IMPORTANT: BACnet reserves network numbers 0 and 65,535 for special purposes. Don't use network 0 or 65,535.
  - d. MAC Addresses Hardware-Oriented. The MAC address uniquely identifies a device on its particular network. Each network type—Ethernet and MS/TP—has its own MAC addressing scheme. A device that exists on two or more networks will have a MAC address for each one. Devices can have the same MAC addresses as long as they are on networks with different network numbers.
  - e. Note: It's helpful to think of the MAC address as a house number and the network number as the street number. Two houses can have the same house number (MAC address) as long as they are on different streets (networks).
  - f. Ethernet Devices: For Ethernet LANs, the IEEE assigns a certain range of MAC addresses to manufacturers of Ethernet products. The manufacturer then assigns a unique MAC address to each of its Ethernet devices.
  - g. MS/TP Devices: For devices on an MS/TP LAN, you assign the MAC address for each controller. For BACtalk VLCs, these are assigned with DIP switches. Devices on an MS/TP LAN are designated as either masters or slaves, which affects how they can be addressed. This is a requirement of the BACnet specification. All BACtalk MS/TP devices are masters.
  - h. IMPORTANT: BACnet reserves MS/TP MAC address 255 for special purposes. Don't use MS/TP MAC 255.
  - i. Device Instances Software-Oriented. The device instance identifies the device to the BACnet software and is the address most often encountered. The device instance is a shortcut to having to specify a MAC address and network number each time an operation is performed. Device instances range from 0–4194302.
  - j. Note: BACnet reserves device instance 4194303 for special purposes. Don't use device instance 4194303.

G. Warranty:

1. Warranty shall cover all costs for parts, labor, associated travel, and expenses for a period of one (1) year from completion of system acceptance.
2. Hardware and software personnel supporting this warranty agreement shall provide on-site or off-site service in a timely manner after failure notification to the vendor. The maximum acceptable response time to provide this service at the site shall be 24 hours, Monday through Friday, and 48 hours on Saturday and Sunday.
3. This warranty shall apply equally to both hardware and software.

**1.5 DELIVERY, STORAGE AND HANDLING**

- A. Provide equipment and control devices in factory shipping carton. Maintain in cartons while shipping, storing and handling as required to prevent equipment damage and to keep dirt and moisture from equipment. Store equipment and materials inside and protect from weather.

**PART 2 - PRODUCTS****2.1 SYSTEM DESCRIPTION**

- A. A distributed logic control system complete with all software and hardware functions shall be provided and installed. System shall be completely based on ANSI/ASHRAE Standard 135-2008, BACnet and achieved listing under the BACnet Testing Laboratories BACnet - Advanced Workstation Software (B-AWS). This system is to control all mechanical equipment, including all unitary equipment such as VAV boxes, heat pumps, fan-coils, AC units, etc., and all air handlers, boilers, chillers, and any other listed equipment using native BACnet-compliant components. Non-BACnet-compliant or proprietary equipment or systems (including gateways) will not be acceptable and are specifically prohibited.
- B. The existing Operator's workstation software shall be used. Tie new building and its controls into the existing BCC operator workstation.
- C. The Energy Management and Control System (EMCS) application program shall be written to communicate specifically utilizing BACnet protocols. Software functions delivered on this project shall include password protection, scheduling (including optimum start), alarming, logging of historical data, full graphics including animation, after-hours billing program, demand limiting, and a full suite of field engineering tools including graphical programming and applications. Systems using operating systems other than that described above are strictly prohibited. All software required to program application specific controllers and all field level devices and controllers will be left with the Owner. All software passwords required to program and make future changes to the system will also become the property of the Owner. All software required to make any program changes anywhere in the system, along with scheduling and trending applications, will be left with the Owner. All software passwords required to program and make future changes to schedules, trends and related program changes will also become the property of the Owner. All software required for all field engineering tools including graphical programming and applications will be left with the Owner. All software passwords required to program and make future changes to field engineering tools, including graphical programming and applications will be left with the Owner.
- D. Building controllers shall include complete energy management software, including scheduling building control strategies with optimum start and logging routines. All energy management software and firmware shall be resident in field hardware and shall not be dependent on the operator's terminal. Operator's terminal software is to be used for access to field-based energy management functions only. Provide zone-by-zone direct digital logic control of space temperature, scheduling, runtime accumulation, equipment alarm reporting, and override timers for after-hours usage.
- E. All application controllers for every unit, air handler, all central plant equipment, and any other piece of controlled equipment shall be fully programmable. Application controllers shall be mounted next to controlled equipment and communicate with building controller through BACnet LAN.
- F. All control equipment used to perform any or all of the specified smoke control sequences shall be UL-864 UUKL listed. This includes all field controllers and global control devices. Non-UUKL rated equipment shall not be networked to any devices on the network performing smoke control sequences unless isolated by a UUKL-rated device.
- G. Password Protection:
  - 1. Provide security system that prevents unauthorized use unless operator is logged on. Access shall be limited to operator's assigned functions when user is logged on. This includes displays as outlined above.
  - 2. Each operator's terminal shall provide security for a minimum of 200 users. Each user shall have an individual User ID, User Name, and Password. Entries are alphanumeric characters only and are case sensitive (except for User ID). User ID shall be 0-8 characters, User Name shall be 0-29 characters, and Password shall be 4-8 characters long. Each system user shall be allowed individual assignment of only those control functions, menu items, and user specific system start display, as well restricted access to

discrete BACnet devices to which that user requires access. All passwords, user names, and access assignments shall be adjustable online at the operator's terminal. Users should have the capability to be assigned to specific user type "groups" that can share the same access levels to speed setup. Users who are members of multiple "groups" shall have the ability to activate/deactivate membership to those groups while using the BAS (without logout). Users shall also have a set security level, which defines access to displays and individual objects the user may control. System shall include 10 separate and distinct security levels for assignment to users.

3. System shall include an Auto Logout Feature that shall automatically logout user when there has been no keyboard or mouse activity for a set period of time. Time period shall be adjustable by system administrator. Auto Logout may be enabled and disabled by system administrator. Operator terminal shall display message on screen that user is logged out after Auto Logout occurs.
4. The system shall permit the assignment of an effective date range, as well as an effective time of day, that the User IDs are permitted to authenticate.

H. Operator Activity Log:

1. Operator Activity Log that tracks all operator changes and activities shall be included with system. System shall track what is changed in the system, who performed this change, date and time of system activity, and value of the change before and after operator activity. Operator shall be able to display all activity, sort the changes by user and also by operation. Operator shall be able to print the Operator Activity log display.
2. Log shall be gathered and archived to hard drive on operator's workstation as needed. Operator shall be able to export data for display and sorting in a spreadsheet.
3. Any displayed data that is changeable by the operator may be selected using the right mouse button and the operator activity log shall then be selectable on the screen. Selection of the operator activity log using this method shall show all operator changes of just that displayed data.

I. Scheduling:

1. Operator's workstation shall show all information in easy-to-read daily format including calendar of this month and next. All schedules shall show actual ON/OFF times for day based on scheduling priority. Priority for scheduling shall be events, holidays and daily, with events being the highest.
2. Holiday and special event schedules shall display data in calendar format. Operator shall be able to schedule holidays and special events directly from these calendars.
3. Operator shall be able to change all information for a given weekly or exception schedule if logged on with the appropriate security access.
4. System shall include a Schedule Wizard for set up of schedules. Wizard shall walk user through all steps necessary for schedule generation. Wizard shall have its own pull-down selection for startup or may be started by right-clicking on value displayed on graphic and then selecting Schedule.
5. Scheduling shall include optimum start based on outside air temperature, current heating/cooling setpoints, indoor temperature and history of previous starts. Each and every individual zone shall have optimum start time independently calculated based on all parameters listed. User shall input schedules to set time that occupied setpoint is to be attained. Optimum start feature shall calculate the startup time needed to match zone temperature to setpoint. User shall be able to set a limit for the maximum startup time allowed.
6. Any displayed data that is changeable by the operator may be selected using the right mouse button and the schedule shall then be selectable on the screen. Selection of the schedule using this method shall allow the viewing of the assigned schedule or launch the Schedule Wizard to allow the point to be scheduled.

J. Alarm Indication and Handling:

1. Operator's workstation shall provide audible, visual, printed, and email means of alarm indication. The alarm dialog box shall always become the top dialog box regardless of the

- application(s) currently running. Printout of alarms shall be sent to the assigned terminal and port. Alarm notification can be filtered based on the User ID's authorization level.
  2. System shall provide log of alarm messages. Alarm log shall be archived to the hard disk of the system operator's terminal. Each entry shall include a description of the event-initiating object generating the alarm. Description shall be an alarm message of at least 256 characters in length. Entry shall include time and date of alarm occurrence, time and date of object state return to normal, time and date of alarm acknowledgment, and identification of operator acknowledging alarm.
  3. Alarm messages shall be in user-definable text (English or other specified language) and shall be delivered either to the operator's terminal, client or through remote communication using email (Authenticated SMTP supported).
  4. System shall include an Alarm Wizard for set up of alarms. Wizard shall walk user through all steps necessary for alarm generation. Wizard shall have its own pull-down selection for startup or may be started by right-clicking on value displayed on graphic and then selecting alarm setup.
  5. Any displayed data that is changeable by the operator may be selected using the right mouse button and the alarm shall then be selectable on the screen. Selection of the alarm using this method shall allow the viewing of the alarm history or launch the Alarm Wizard to allow the creation of a new alarm.
- K. Trendlog Information:
1. System server shall periodically gather historically recorded data stored in the building controllers and store the information in the system database. Stored records shall be appended with new sample data, allowing records to be accumulated. Systems that write over stored records shall not be allowed unless limited file size is specified. System database shall be capable of storing up to 50 million records before needing to archive data. Samples may be viewed at the operator's workstation. Operator shall be able to view all trended records, both stored and archived. All trendlog records shall be displayed in standard engineering units.
  2. Software that is capable of graphing the trend logged object data shall be included. Software shall be capable of creating two-axis (X, Y) graphs that display up to 10 object types at the same time in different colors. Graphs shall show object values relative to time. Each trendlog shall support a custom scale setting for the graph view that is to be stored continuously. System shall be capable of trending on an interval determined by a polling rate, or change-of-value.
  3. Operator shall be able to change trendlog setup information. This includes the information to be logged as well as the interval at which it is to be logged. All input, output, and value object types in the system may be logged. All operations shall be password protected. Setup and viewing may be accessed directly from any and all graphics on which object is displayed.
  4. System shall include a Trend Wizard for setup of logs. Wizard shall walk user through all necessary steps. Wizard shall have its own pull-down selection for startup, or may be started by right-clicking on value displayed on graphic, and then selecting Trendlogs from the displayed menu.
  5. System shall be capable of using Microsoft SQL as the system database.
  6. Any displayed data that is changeable by the operator may be selected using the right mouse button and the trendlog shall then be selectable on the screen. Selection of the trendlog using this method shall allow the viewing of the trendlog view or launch the Trendlog wizard to allow the creation of a new trend.
- L. Energy Log Information:
1. System server shall be capable of periodically gathering energy log data stored in the field equipment and archive the information. Archive files shall be appended with new data, allowing data to be accumulated. Systems that write over archived data shall not be allowed unless limited file size is specified. Display all energy log information in standard engineering units.

2. All data shall be stored in database file format for direct use by third-party programs. Operation of system shall stay completely online during all graphing operations.
  3. Operator shall be able to change the energy log setup information as well. This includes the meters to be logged, meter pulse value, and the type of energy units to be logged. All meters monitored by the system may be logged. System shall support using flow and temperature sensors for BTU monitoring.
  4. System shall display archived data in tabular format form for both consumption and peak values. Data shall be shown in hourly, daily, weekly, monthly and yearly formats. In each format, the user shall be able to select a specific period of data to view.
- M. Demand Limiting:
1. System shall include demand limiting program that includes two types of load shedding. One type of load shedding shall shed/restore equipment in binary fashion based on energy usage when compared to shed and restore settings. The other type of shedding shall adjust operator selected control setpoints in an analog fashion based on energy usage when compared to shed and restore settings. Shedding may be implemented independently on each and every zone or piece of equipment connected to system.
  2. Binary shedding shall include minimum of five (5) priority levels of equipment shedding. All loads in a given priority level shall be shed before any loads in a higher priority level are shed. Load shedding within a given priority level shall include two methods. In one, the loads shall be shed/restored in a "first off-first on" mode, and in the other the loads are just shed/restored in a "first off-last on" (linear) fashion.
  3. Analog shed program shall generate a ramp that is independently used by each individual zone or individual control algorithm to raise the appropriate cooling setting and lower appropriate heating setting to reduce energy usage.
  4. Status of each and every load shed program shall be capable of being displayed on every operator terminal connected to system. Status of each load assigned to an individual shed program shall be displayed along with English description of each load.
- N. Reports:
1. System server shall be capable of periodically producing reports of trendlogs, alarm history, tenant activities, device summary, energy logs and override points. The frequency, content and delivery are to be user adjustable.
  2. All reports shall be capable of being delivered in multiple formats including text- and comma-separated value (CSV) files. The files can be printed, emailed or saved to a folder, either on the server hard drive or on any network drive location.
- O. Configuration/Setup:
1. Provide means for operator to display and change system configuration. This shall include, but not be limited to, system time, day of the week, date of daylight savings set forward/set back, printer termination, port addresses, modem port and speed, etc. Items shall be modified using understandable terminology with simple mouse/cursor key movements.
- P. Field Engineering Tools:
1. If a system other than Hoffman Building Technologies is used, then provide (2) portable operator field engineering tools. This shall include Core i5 based laptops, backpack style cases and all software / hardware needed for programing and troubleshooting field controllers. All controllers shall be programmed using graphical tools that allow the user to connect function blocks on screen that provide sequencing of all control logic. Function blocks shall be represented by graphical displays that are easily identified and distinct from other types of blocks. Graphical programming that uses simple rectangles and squares is not acceptable.
  2. User shall be able to select a graphical function block from menu and place on screen. Provide zoom in and zoom out capabilities. Function blocks shall be downloaded to controller without any reentry of data.
  3. Programming tools shall include a real-time operation mode. Function blocks shall display real-time data and be animated to show status of data inputs and outputs when in real-time

operation. Animation shall show change of status on logic devices and countdown of timer devices in graphical format.

4. Field engineering tools shall also include a database manager of applications that include logic files for controllers and associated graphics. Operator shall be able to select unit type, input/output configuration and other items that define unit to be controlled. Supply minimum of 250 applications as part of workstation software.
5. Field engineering tool shall include Device Manager for detection of devices connected anywhere on the BACnet network by scanning of the entire network. This function shall display device instance, network identification, model number, and description of connected devices. It shall record and display software file loaded into each controller. A copy of each file shall be stored on the computer's hard drive. If needed, this file shall be downloaded to the appropriate controller using the mouse.
6. System shall automatically notify the user when a device that is not in the database is added to the network.
7. System shall include backup/restore function that will back up entire system to selected medium and then restore system from that media. The system shall be capable of creating a backup for the purpose of instantiating a new client PC.
8. The system shall provide a means to scan, detect, interrogate, and edit third-party BACnet devices and BACnet objects within those devices.

Q. Software:

1. At the conclusion of project, contractor shall leave with owner a digital media copy that includes the complete software operation system and project graphics, setpoints, system parameters, etc. This backup shall allow the owner how to completely restore the system in the case of a computer malfunction.

## 2.2 WEB INTERFACE

- A. General: The system shall utilize the existing web interface platform and be integrated 100% for cohesiveness both visually and functionally
- B. Browser Technology: Browser shall be Internet Explorer v10.0 or later, Firefox v3.6 or later, Safari v2.0 or later (on Mac OS X). WEBtalk browsers: Internet Explorer 8.0, Firefox, Safari on Mac. WEBtalk mobile client support: Microsoft Mobile WAP browser, Blackberry. No special vendor-supplied software shall be needed on computers running browser. All displays shall be viewable and the webpage host shall directly access real-time data from the BAS BACnet network. Data shall be displayed in real-time and update automatically without user interaction. User shall be able to change data on displays if logged in with the appropriate user name and password.
- C. Communications:
  1. Webpage host shall include two (2) Ethernet network connections. One (1) network connection shall be dedicated to BAS BACnet network and shall be used to gather real-time data from all the BACnet devices that form the BAS. This network shall communicate using BACnet, allowing the webpage host to gather data directly from units on the local LAN or from other projects connected over a WAN. This network shall also provide the connection to the BAS server for webpage generation.
  2. The second Ethernet connection shall provide the physical connection to the Internet or an IP-based WAN. It shall be the port that is used for the browser to receive web pages and data from the webpage host. The webpage host shall act as a physical barrier between the BAS network and the WAN or Internet connection that allows the browser to receive webpages and data. The two separate network connections provide for a physical barrier to prevent raw BACnet traffic being exposed on the IP network.
  3. The webpage host shall provide for complete isolation of the IP and BACnet networks by not routing networking packets between the two networks.
  4. BAS BACnet Ethernet network shall be provided and installed by the BAS supplier. Owner shall provide and incur any monthly charges of WAN/Internet connection.
- D. Display of Data:

1. Webpage graphics shown on browser shall be replicas of the BAS displays. User shall need no additional training to understand information presented on webpages when compared to what is shown on BAS displays. Webpage displays shall include animation just as BAS displays. Fans shall turn, pilot lights shall blink, coils shall change colors, and so on.
  2. Real-time data shall be shown on all browser webpages. This data must be directly gathered using the BACnet network and automatically updated on browser webpage displays without any user action. Data on the browser shall automatically refresh as changes are detected without re-drawing the complete display.
  3. It shall be possible for user from browser webpage to change data if the user is logged on with the appropriate password. Clicking on a button or typing in a new value shall change digital data. Using pull-down menus or typing in a new value shall change analog data.
  4. Data displays shall be navigated using pushbuttons on the displays that are simply clicked on with the mouse to select a new display. Alternatively, the standard back and forward buttons of the browser can be used for display navigation.
- E. Time Schedule Adjustment:
1. Web access shall allow user to view and edit all schedules in the system. This includes standard, holiday and event schedules as described in BAS specification. Display of schedules shall show interaction of all schedules on a single display so user sees an overview of how all work together. User shall be able to edit schedules from this display.
  2. Display of all three schedules must show all ON times for standard, holiday and event schedules in different colors on a given day. In addition, OFF times for each must also be shown in additional colors. User shall be able to select from standard calendar what days are to be scheduled and same display shall show all points and zones affected. User shall be able to set time for one day and select all days of the week that shall be affected as a recurrence of that same schedule for that given day.
  3. Schedule list shall show all schedules currently defined. This list shall include all standard, holiday and event schedules. In addition, user shall be able to select a list that shows all scheduled points and zones.
- F. Logging of Information: User shall use standard browser technology to view all trendlogs in system. User shall be able to view logged data in tabular form or graphical format. User shall be able to adjust time interval of logged data viewed and shall be able to adjust Y axis of data viewed in graphical format. User shall also be able to download data through the web interface to local computer. Data shall be in CSV format.
- G. Alarm Handling: Web interface shall display alarms as they occur. User shall be able to acknowledge alarms using browser technology. In addition, user shall be able to view history of alarm occurrence over a user-selected time frame. In addition, those alarms may be filtered for viewing per user-selected options. A single selection shall display all alarms that have not been acknowledged.
- H. Webpage Generation: Webpages shall be automatically generated from the BAS displays that reside on the BAS server. User shall access webpage host through the network and shall initiate a webpage generation utility that automatically takes the BAS displays and turns them into webpages. The webpages generated are automatically installed on the webpage host for access using any computer's standard browser. Any system that requires use of an HTML editor for generation of webpages shall not be considered.
- I. Password Security and Activity Log: Access through web browser shall utilize the same hierarchical security scheme as BAS system. User shall be asked to log on once the browser makes connection to webpage host. Once the user logs in, any and all changes that are made shall be tracked by the BAS system. The user shall be able to change only those items he or she has authority to change. A user activity report shall show any and all activity of the users who have logged in to the system, regardless of whether those changes were made using a browser or through the BAS workstation.



- J. BACnet Communication: Web server shall directly communicate to all devices on the BAS network using BACnet protocol. No intermediate devices shall be necessary for BACnet communication.

### 2.3 GRAPHICS DISPLAYS

- A. Operator's workstation shall display all data associated with project as called out on drawings and/or object type list supplied. Graphic files shall be created using digital, full color photographs of system installation, AutoCAD or Visio drawing files of field installation drawings and wiring diagrams from as-built drawings. Operator's workstation shall display all data using three-dimensional graphic representations of all mechanical equipment. System shall be capable of displaying graphic file, text, and dynamic object data together on each display and shall include animation. Information shall be labeled with descriptors and shall be shown with the appropriate engineering units. All information on any display shall be dynamically updated without any action by the user. Workstation shall allow user to change all field-resident EMCS functions associated with the project, such as setpoints, weekly schedules, exception schedules, etc., from any screen, no matter if that screen shows all text or a complete graphic display. This shall be done without any reference to object addresses or other numeric/mnemonic indications.
- B. All displays and programming shall be generated and customized by the local EMCS supplier and installer. Systems requiring factory development of graphics or programming of DDC logic are specifically prohibited.
- C. Binary objects shall be displayed as ACTIVE/INACTIVE/NULL or with customized text such as Hand-Off-Auto. Text shall be justified left, right or center as selected by the user. Also, allow binary objects to be displayed as individual change-of-state graphic objects on the display screen such that they overlay the system graphic. Each binary object displayed in this manner shall be assigned up to three (3) graphic files for display when the point is ON, OFF or in alarm. For binary outputs, toggle the object's commanded status when the graphic item is selected with the system mouse. Similarly, allow the workstation operator to toggle the binary object's status by selecting with the mouse, for example, a graphic of a switch or light, which then displays a different graphic (such as an "ON" switch or lighted lamp. Additionally, allow binary objects to be displayed as an animated graphic. Animated graphic objects shall be displayed as a sequence of multiple graphics to simulate motion. For example, when a pump is in the OFF condition, display a stationary graphic of the pump. When the operator selects the pump graphic with the mouse, the represented object's status is toggled and the graphic of the pump's impeller rotates in a time-based animation. The operator shall be able to click an animated graphical object or switch it from the OFF position to ON, or ON to OFF. Allow operator to change graphic file assignment and also create new and original graphics online. System shall be supplied with a library of standard graphics, which may be used unaltered or modified by the operator. Systems that do not allow customization or creation of new graphic objects by the operator (or with third-party software) shall not be allowed.
- D. Analog objects shall be displayed with operator modifiable units. Analog input objects may also be displayed as individual graphic items on the display screen as an overlay to the system graphic. Each analog input object may be assigned a minimum of five (5) graphic files, each with high/low limits for automatic selection and display of these graphics. As an example, a graphic representation of a thermometer would rise and fall in response to either the room temperature or its deviation from the controlling setpoint. Analog output objects, when selected with the mouse, shall be displayed as a prompted dialog (text only) box. Selection for display type shall be individual for each object. Analog object values may be changed by selecting either the "increase" or "decrease" arrow in the analog object spinner box without using the keypad. Pressing the button on the right side of the analog object spinner box allows direct entry of an analog value and accesses various menus where the analog value may be used, such as trendlogs.
- E. A customized menu label (pushbutton) shall be used for display selection. Menu items on a display shall allow penetration to lower level displays or additional menus. Dynamic point information and menu label pushbuttons may be mixed on the same display to allow sub-displays to exist for each item. Each display may be protected from viewing unless operator has

appropriate security level. A security level may be assigned to each display and system object. The menu label shall not appear on the graphic if the operator does not have the appropriate security level.

- F. The BAS displays shall have the ability to link to content outside of the BAS system. Such content shall include but is not limited to: Launching external files in their native applications (for example, a Microsoft Word document) and launching a web browser resolving to a specified web address.
- G. The BAS system shall have the ability to run multiple, concurrent displays windows showing continuously updated data.

## 2.4 BUILDING CONTROLLER

### A. General Requirements:

1. BACnet Conformance:
  - a. Building Controller shall be approved by the BTL as meeting the BACnet Building Controller requirements.
  - b. Please refer to section 22.2, BACnet Functional Groups, in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
2. Existing building shall be extended for all new controls.
3. Building controller shall be of modular construction such that various modules may be selected to fit the specific requirements of a given project. At a minimum, modules shall consist of a power supply module, a BACnet Ethernet-MS/TP (master slave token passing) module, a BACnet MS/TP-only module, and a modem module for telephone communication. Those projects that require special interfaces may use Modbus modules as needed. However, all Ethernet communications and all controllers—including central plant controllers, advanced application controllers and unitary controllers—supplied by BAS manufacturer shall utilize the BACnet protocol standard.
4. Modules shall be selected to fit the particular project application. Up to seven (7) modules shall be powered by a single power supply module. All modules shall be panel-mounted on DIN rail for ease of addition and shall be interconnected using a simple plug-in cable. A module in the middle shall be replaceable without removing any other modules.
5. All modules shall be capable of providing global control strategies for the system based on information from any objects in the system, regardless if the object is directly monitored by the building controller module or by another controller. The software program implementing these strategies shall be completely flexible and user-definable. All software tools necessary for programming shall be provided as part of project software. Any systems utilizing factory pre-programmed global strategies that cannot be modified by field personnel on-site, using a WAN or downloaded through remote communications are not acceptable. Changing global strategies using firmware changes is also unacceptable.
6. Programming shall be object-oriented using control function blocks, and support DDC functions, 1000 Analog Values and 1000 Binary Values. All flowcharts shall be generated and automatically downloaded to controller. Programming tool shall be supplied and be resident on workstation. The same tool shall be used for all controllers.
7. Provide means to graphically view inputs and outputs to each program block in real-time as program is executing. This function may be performed using the operator's workstation or field computer.
8. Controller shall have sufficient memory to ensure high performance and data reliability. Battery shall provide power for orderly shutdown of controller and storage of data in nonvolatile flash memory. Battery backup shall maintain real-time clock functions for a minimum of 20 days.
9. Global control algorithms and automated control functions shall execute using 32-bit processor.
10. Schedules:

- a. Each building controller module shall support a minimum of 80 BACnet Schedule Objects and 80 BACnet Calendar Objects.
  - b. Building controller modules shall provide normal 7-day scheduling, holiday scheduling and event scheduling.
- 11. Logging Capabilities:
  - a. Each building controller shall log as minimum 320 values. Any object in the system (real or calculated) may be logged. Sample time interval shall be adjustable at the operator's workstation.
  - b. Logs may be viewed both on-site or off-site using WAN or remote communication.
  - c. Building controller shall periodically upload trended data to networked operator's workstation for long-term archiving if desired.
  - d. Archived data stored in database format shall be available for use in third-party spreadsheet or database programs.
- 12. Alarm Generation:
  - a. Alarms may be generated within the system for any object change of value or state (either real or calculated). This includes things such as analog object value changes, binary object state changes, and various controller communication failures.
  - b. Each alarm may be dialed out as noted elsewhere.
  - c. Alarm log shall be provided for alarm viewing. Log may be viewed on-site at the operator's terminal or off-site using remote communications.
  - d. Controller must be able to handle up to 320 alarm setups stored as BACnet event enrollment objects, with system destination and actions individually configurable.
- 13. Demand Limiting:
  - a. Demand limiting of energy shall be a built-in, user-configurable function. Each controller module shall support shedding of up to 200 loads using a minimum of two types of shed programs.
  - b. Load shedding programs in building controller modules shall operate as defined in section 2.1.J of this specification.
- 14. Tenant Activity Logging:
  - a. Tenant Activity logging shall be supported by building controller module. Each independent module shall support a minimum of 80 zones.
  - b. Tenant Activity logging shall function as defined in section 2.1.K of this specification.
- B. Ethernet – MS/TP Module:
  - 1. Ethernet – MS/TP Module shall support every function as listed under paragraph A, General Requirements, of this section and the following.
  - 2. All communication with operator's workstation and all application controllers shall be through BACnet. Building controller Ethernet – MS/TP module shall incorporate as a minimum, the functions of a 2-way BACnet router. Controller shall route BACnet messages between the high-speed LAN (Ethernet 10/100MHz) and MS/TP LAN. Ethernet – MS/TP module shall also route messages from all other building controller modules onto the BACnet Ethernet network.
    - a. MS/TP LAN must be software-configurable from 9.6 to 76.8Kbps.
    - b. The RJ-45 Ethernet connection must accept either 10Base-T or 100Base-TX BACnet over twisted pair cable (UTP).
  - 3. BACnet Conformance:
    - a. Ethernet – MS/TP module shall, as a minimum, support MS/TP and Ethernet BACnet LAN types. It shall communicate directly using these BACnet LANs as a native BACnet device and shall support simultaneous routing functions between all supported LAN types. Global controller shall be approved by the BACnet Testing Laboratory (BTL) as meeting the BACnet Building Controller requirements.

- b. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
  - c. The building controller shall comply with Annex J of the BACnet specification for IP connections. This device shall use Ethernet to connect to the IP internetwork, while using the same Ethernet LAN for non-IP communications to other BACnet devices on the LAN. Must support interoperability on WANs and CANs and function as a BACnet Broadcast Management Device (BBMD).
- C. MS/TP Module:
  - 1. MS/TP module shall support every function as listed under paragraph A, General Requirements, of this section and the following.
  - 2. Building controller MS/TP module communications shall be through BACnet MS/TP LAN to all advanced application and application-specific controllers. MS/TP module shall also route messages to Ethernet – MS/TP module for communication over WAN.
    - a. MS/TP LAN must be software configurable from 9.6 to 76.8Kbps
    - b. Configuration shall be through RS-232 connection.
  - 3. BACnet Conformance:
    - a. MS/TP module shall be approved by the BTL (BACnet Testing Laboratory) as meeting the BACnet Building Controller requirements. MS/TP module shall as a minimum support MS/TP BACnet LAN type. It shall communicate directly using this BACnet LAN as a native BACnet device and shall support simultaneous routing functions between all supported LAN types.
    - b. Standard BACnet object types supported shall include, as a minimum, Analog Value, Binary Value, Calendar, Device, File, Group, Notification Class, Program, and Schedule object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
- D. Power Supply Module:
  - 1. Power supply module shall power up to seven (7) building controller modules. Input for power shall accept between 17~–30VAC, 47–65Hz.
  - 2. Power supply module shall include rechargeable battery for orderly shutdown of controller modules including storage of all data in flash memory and for continuous operation of real-time clocks for minimum of 20 days.
- E. Modbus Module:
  - 1. Modbus Module shall support every function as listed under paragraph A, General Requirements, of this section and the following.
  - 2. Building Controller Modbus module communications shall be via one of three types of ports: EIA-485, EIA-422 or RS-232 connection. Modbus module shall convert Modbus data into BACnet objects. Modbus module shall also route messages to Ethernet-MS/TP module for BACnet Ethernet communication over WAN.
    - a. Modbus Module shall support ASCII or RTU Modbus communication at 9600 or 4800 baud.
    - b. EIA-422 and EIA-232 connection shall support one connection of Modbus unit.
    - c. EIA-485 connection shall support connection of up to 247 Modbus units.
    - d. Configuration shall be via RS-232 connection.
  - 3. BACnet Translation:
    - a. All Modbus data shall be translated into BACnet objects by the Modbus module. All configuration tools shall be supplied to assure data is translated as necessary to the correct format and value.
    - b. Standard BACnet object types supported shall include as a minimum: Analog Value, Binary Value, Calendar, Device, File, Group, Notification Class, Program and Schedule object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

## 2.5 CENTRAL PLANT AND AIR HANDLER APPLICATION CONTROLLERS

### A. Central Plant and Air Handler Application Controllers:

1. Provide one or more native BACnet application controllers for each air handler and provide native BACnet application controllers as needed for central plant control that adequately cover all objects listed in object list. All controllers shall interface to building controller through either MS/TP LAN using BACnet protocol, or Ethernet LAN using BACnet over Ethernet or BACnet TCP/IP. No gateways shall be used. Controllers shall include input, output and self-contained logic program as needed for complete control of units. Controllers shall be fully programmable using graphical programming blocks. Programming tool shall be resident on operator workstation and be the same tool as used for the building controller. No auxiliary or non-BACnet controllers shall be used.
2. BACnet Conformance:
  - a. Application controllers shall be approved by the BTL as meeting the BACnet Advanced Application Controller requirements.
  - b. Please refer to section 22.2, BACnet Functional Groups, in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
  - c. Standard BACnet object types supported shall include, as a minimum, Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Binary Value, Multi-state Values, Device, File, and Program object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
3. Application controllers shall include universal inputs with 12-bit resolution that accept 3K and 10K thermistors, 0–10VDC, 0–5VDC, 4–20mA and dry contact signals. Any input on a controller may be either analog or digital with a minimum of three (3) inputs that accept pulses. Controller shall also include support and modifiable programming for interface to intelligent room sensor with digital display. Controller shall include binary and analog outputs on board. Analog outputs with 12-bit resolution shall support either 0–10VDC or 0–20mA. Binary outputs shall have LED indication of status. Software shall include scaling features for analog outputs. Application controller shall include 20VDC voltage supply for use as power supply to external sensors.
  - a. All outputs must have on-board Hand-Off-Auto (HOA) switches and a status indicator light. HOA switch position shall be monitored. Each analog output shall include a potentiometer for manually adjusting the output when the HOA switch is in the Hand position. The position of each and every HOA switch shall be available system wide as a BACnet object property.
4. All program sequences shall be stored on board application controller in EEPROM. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller up to 20 times per second (minimum of 10 times per second) and capable of multiple PID loops for control of multiple devices. All calculations shall be completed using floating-point math and system shall support display of all information in floating-point nomenclature at operator's terminal.
  - a. The following control blocks shall be supported:
    - 1) Natural Log
    - 2) Exponential
    - 3) Log base 10
    - 4) X to the power of Y
    - 5) Nth square root of X
    - 6) 5th Order Polynomial Equations
    - 7) Astronomical Clock (sunrise/sunset calculation)
    - 8) Time-based schedules

5. Programming of application controller shall be completely modifiable in the field over installed BACnet LANs or remotely using modem interface. Operator shall program logic sequences by graphically moving function blocks on screen and tying blocks together on screen. Application controller shall be programmed using programming tools as described in operator's terminal section.
6. Application controller shall include support for intelligent room sensor. Display on intelligent room sensor shall be programmable at application controller and include an operating mode and a field service mode. All button functions and display data shall be programmable to show specific controller data in each mode, based on which button is pressed on the sensor. See sequence of operation for specific display requirements at intelligent room sensor.
7. Schedules:
  - a. The controller shall support a minimum of three (3) BACnet Schedule Objects and have a real-time clock on board with battery backup to maintain time through a power loss.
8. Logging Capabilities:
  - a. Controller shall support a minimum of 50 trendlogs. Any object in the controller (real or calculated) may be logged. Sample time interval shall be adjustable at the operator's workstation.
  - b. Controller shall periodically upload trended data to system server for long-term archiving if desired. Archived data stored in (MS Jet Database or SQL) database form and shall be available for use in third-party spreadsheet or database programs.
9. Alarm Generation:
  - a. Alarms may be generated within the controller for any object change of value or state (either real or calculated). This includes things such as analog object value changes, and binary object state changes.
  - b. Alarm log shall be provided for alarm viewing. Log may be viewed on-site at the operator's terminal or off-site using remote communications.
  - c. Controller must be able to handle up to 25 alarm setups stored as BACnet event enrollment objects, with system destination and actions individually configurable.
10. The controller processor shall be a 32-bit processor.
11. The packaging of the controller shall provide operable doors to cover the terminals once installation is complete. The housing of the controller shall provide for DIN rail mounting and also fully enclose circuit board.

## 2.6 TERMINAL UNIT APPLICATION CONTROLLERS

- A. Provide one (1) native BACnet application controller for each piece of unitary mechanical equipment that adequately covers all objects listed in object list for unit. All controllers shall interface to building controller through MS/TP LAN using BACnet protocol. No gateways shall be used. Controllers shall include input, output and self-contained logic program as needed for complete control of unit.
- B. BACnet Conformance:
  1. Application controllers shall, as a minimum, support MS/TP BACnet LAN types. They shall communicate directly using this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as a native BACnet device. Application controllers shall be approved by the BTL as meeting the BACnet Application Specific Controller requirements and support all BACnet services necessary to provide the following BACnet functional groups:
    - a. Files Functional Group
    - b. Reinitialize Functional Group
    - c. Device Communications Functional Group
  2. Please refer to Section 22.2, BACnet Functional Groups in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be

thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

3. Standard BACnet object types supported shall include, as a minimum, Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Binary Value, Device, File, and Program Object Types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
- C. Application controllers shall include universal inputs with 10-bit resolution that can accept 3K and 10K thermistors, 0–5VDC, 4–20mA, dry contact signals and a minimum of three (3) pulse inputs. Any input on controller may be either analog or digital. Controller shall also include support and modifiable programming for interface to intelligent room sensor. Controller shall include binary outputs on board with analog outputs as needed.
- D. All program sequences shall be stored on board controller in EEPROM. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller 10 times per second and shall be capable of multiple PID loops for control of multiple devices. Programming of application controller shall be completely modifiable in the field over installed BACnet LANs or remotely through modem interface. Operator shall program logic sequences by graphically moving function blocks on screen and tying blocks together on screen. Application controller shall be programmed using same programming tools as building controller and as described in operator workstation section. All programming tools shall be provided and installed as part of system.
- E. Application controller shall include support for intelligent room sensor. Display on room sensor shall be programmable at controller and include an operating mode and a field service mode. All button functions and display data shall be programmable to show specific controller data in each mode based on which button is pressed on the sensor. See sequence of operation for specific display requirements at intelligent room sensor.

## 2.7 PRODUCTS

- A. Room sensors shall be provided with digital readout that allow the user to view room temperature, view room relative humidity, adjust the room setpoints for temperature and relative humidity within preset limits. User shall also be able to override the unit's Occupied/Unoccupied schedule from the digital sensor. Include all necessary wiring and firmware such that room sensor includes field service mode. Field service mode shall allow a technician to access any parameter in controller directly from the room sensor. Field service mode shall have the ability to be locked out.
  1. Room sensors shall have an accuracy for temperature of  $\pm 1.0^{\circ}\text{F}$ . Minimum operating span shall  $45^{\circ}\text{F}$ . to  $95^{\circ}\text{F}$ .).
  2. Room sensors shall have an accuracy for humidity of plus or minus three percent (3%) at 0 to 90% RH, 12 - 30 VDC input voltage, analog output (0 - 10 VDC or 4 - 20mA output). Operating range shall be 10 to 90% RH and 50 to 113 degree F.
- B. Duct-Mounted Temperature Sensors: 10,000-ohm thermistor Type 2 temperature sensors with an accuracy of  $\pm 0.36^{\circ}\text{F}$ . Duct-mounted sensors shall have an insertion measuring probe of a length appropriate for the duct size, with a temperature range of -4 to 221 degrees F. The sensor shall include a utility box and a gasket to prevent air leakage and vibration noise. For all mixed air and preheat air applications, install bendable averaging duct sensors with a minimum 8 - foot long sensor element. These devices shall have accuracy of 0.5 degrees, F., over the entire range.
- C. Outside Air Sensors:
  1. Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall be provided with a solar shield.
  2. Sensors exposed to wind velocity pressures shall be shielded by a perforated plate that surrounds the sensor element.
  3. Temperature transmitters shall be of NEMA 3R (IP54) or NEMA 4 (IP65) construction and rated for ambient temperatures.
  4. The outdoor sensor shall be capable of being mounted on a roof, pole or side of a building utilizing its preassembled mounting bracket.

5. Outside air relative humidity sensors 0-100% full range of accurate measurement. Operating temperature -4 to 140°F (-20 to 60°C).
  6. Outside air temperature sensors operating temperature range -40 to 140°F, +/- .55°F (+/- .3°C).
- D. Current Sensitive Switches: Solid state, split core current switch that operates when the current level (sensed by the internal current transformer) exceeds the adjustable trip point. Current switch to include an integral LED for indication of trip condition and a current level below trip set point.
  - E. Differential air pressure switches shall be piped in parallel across fans or filters for positive indication of air flow or pressure drop. Static pressure sensing tips shall be used for both high and low inputs. Pressure range shall be adjustable between .07 and 1.0" W.C. Snap acting contact shall be rated at 300 VA at 120 VAC.
  - F. Motor operated control dampers that will not be integral to the equipment shall be furnished by the Control System Contractor. See Section 233300 Air Duct Accessories for specification of motorized control dampers.
  - G. Control damper actuators shall be two-position or proportional electric actuators direct-mount type sized to provide a minimum of 5 in-lb torque per square foot of damper area. Damper actuators shall be spring return type. Operators shall be heavy-duty electronic type for positioning automatic dampers in response to a control signal. Motor shall be of sufficient size to operate damper positively and smoothly to obtain correct sequence as indicated. All applications requiring proportional operation shall utilize truly proportional electric actuators.
  - H. Relays: Start/stop relay model shall provide either momentary or maintained switching action as appropriate for the motor being started. All relays shall be plugged in, interchangeable, mounted on a subbase and wired to numbered terminals strips. Relays installed in panels shall all be DPDT with indicating lamp. Relays installed outside of controlled devices shall be enclosed in a NEMA enclosure suitable for the location. Relays shall be labeled with UR symbol. RIB-style relays are acceptable for remote enable/disable.
  - I. Condensate Level Switch: Shall be plenum-rated water level detection device, conforming to UL 508, consisting of one or more moisture sensors and a NO dry contact to serve as a binary input point connected to the unit's controls to disable mechanical cooling in the event the condensate drain is blocked. Device shall be mounted in the unit's auxiliary drain pan located at the lowest possible level in the auxiliary drain pan. Switch shall be retained by clips and adhesive tape.
  - J. Carbon Monoxide (CO)/Nitrogen Dioxide (NO<sub>2</sub>) Sensing System: System shall consist of control panel with integral and/or remote CO sensors and NO<sub>2</sub> sensors and interface to the control system. Quantity of each type sensor shall be a function of sensor coverage capability. Sensors shall have LED status indicators, electrochemical element sensors for CO, and electromechanical element sensors for NO<sub>2</sub>. All sensing elements shall be capable of field calibration or field replacement with factory calibrated sensing elements. Control panel shall have LED status indicators, visual alarm, microprocessor based control, programmable time delays, and 4-20mA analog output or RS-485 digital signal.
    1. CO sensors shall be measure 0-25- ppm full scale, with accuracy of +/- 3% of full scale and < 5% annual drift. Sensors shall be mounted 3-7 feet from floor.
    2. NO<sub>2</sub> sensors shall measure 0-10 ppm full scale, with accuracy of +6.5% full scale and <+2% monthly drift. NO<sub>2</sub> sensors shall be mounted half the ceiling height and above the vehicle exhaust outlet.
    3. Setpoints shall be:

Toxic Gas	First Alarm Setpoint (TLV-TWA)	Second Alarm Setpoint (TLV-STEL)	Area of Coverage
Carbon Monoxide (CO)	35 ppm	75 ppm	5000 SF/50 Ft Max
Nitrogen Dioxide (NO <sub>2</sub> )	1 ppm	2 ppm	5000 SF/50 Ft Max

- K. Control Power Transformers: Provide step-down transformers for all DDC controllers and devices as required. Transformers shall be sized for the load, but shall be sized for 50 watts, minimum. Transformers shall be UL listed Class 2 type, for 120VAC/24VAC operation.



- L. Line voltage protection: All control system panels that are powered by 120 VAC circuits shall be provided with surge protection. This protection is in addition to any internal protection provided by the manufacturer. The protection shall meet UL, ULC 1449, IEEE C62.41B. A grounding conductor, (minimum 12 AWG), shall be brought to each control panel.
- M. Mylar labels shall be provided to identify all control components and points of connection.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION - GENERAL**

- A. Install systems and materials in accordance with manufacturer's instructions in a neat workmanlike manner and in accordance with Division 1.
- B. Coordinate with other trades on the project as the work progresses so that each will be aware of the extent of all work. Carefully plan all work and check for interferences before installation. No extras will be allowed for changes caused by failure to check for interferences.
- C. Provide structural supports as required for panels and control devices.
- D. Supervise installation of all control dampers.
- E. Install metering devices away from bends and elbows with minimum upstream and downstream straight distances per manufacturer's recommendations and as shown on Drawings.

#### **3.2 CONTROL WIRING**

- A. Install color-coded control wiring without splices between terminal points in accordance with National Electrical Code.
- B. Install circuits over 25 volts with color-coded No. 12 or 14.
- C. Install circuits under 25 volts with color-coded cable as recommended and approved by the manufacturer.
- D. All wiring and cable used shall be plenum rated.
- E. Wiring above hard ceilings, in walls, or where exposed including in mechanical rooms shall be in 3/4" minimum EMT conduit with steel-plated hexagonal compression connectors.
- F. Wiring above lay-in ceilings may be installed as properly supported cable using bridal rings a minimum of 2" in diameter and located a maximum of 10'-0" on center so as to prevent excess sagging from occurring. Wire-ties or cable straps shall not be used for cable support.
- G. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.
- H. Flexible metallic conduit shall be 1/2" minimum in size and not exceed 3'-0" in length.
- I. All wiring in floor slabs or on exterior shall run in rigid conduit.
- J. Except for short apparatus connections, run conduit parallel to or at right angles to the building structure. Conceal conduit in finished spaces. Do not run conduit concealed under insulation or inside ducts.
- K. Mount control devices, and conduit located on ducts or apparatus with external insulation on stand-off support to avoid interference with insulation.
- L. Provide protective sleeves at wall and floor penetrations.
- M. Provide wiring in accordance with this specification Section, NEC requirements, and Division 26 of these specifications, whichever is more stringent.
- N. Number-code or color-code conductors for future identification and service of control system. Color-coded cable with cable diagrams may be used to accomplish cable identification.
- O. Permanently mark terminal blocks for identification.

#### **3.3 TESTING**

- A. When installation of the control system is complete, calibrate equipment and verify transmission media operation before the system is placed on-line.

- B. Provide a cross check of each control point within the control system by making a comparison between the control command and the field-controlled device.
- C. Replace any work found defective. After replacement, repeat test.

**3.4 START-UP AND DEMONSTRATION**

- A. After completion and testing of the installation, regulate, adjust and service as necessary all control devices in the systems, placing each item in complete and proper operation.
- B. Demonstrate all systems to Owner, Architect and Engineer, and that all are operable from local controls in the specified failure mode upon electronic control system failure or loss of power.
- C. Complete all commissioning requirements as necessary to this scope of work as defined on General Notes on Drawings M0.1.

**3.5 INSTRUCTION**

- A. Provide the services of manufacturer's technical personnel for 8 hours of instruction to Owner's personnel in the operation, maintenance and programming of the control system. Orient the training specifically to the system installed rather than a general training course.
- B. Provide training manuals, equipment and material required for classroom training.
- C. Training to include the following items:
  - 1. Operation of equipment
  - 2. Programming
  - 3. Diagnostics
  - 4. Failure recovery procedures
  - 5. Alarm formats (where applicable)
  - 6. Maintenance and calibration
  - 7. Trouble shooting, diagnostics, and repair instructions

**3.6 OCCUPANCY ADJUSTMENTS**

- A. When requested within 12 months of date of Final Acceptance, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three (3) visits to Project during other than normal occupancy hours for this purpose.

**PART 4 - POINTS LISTS AND SEQUENCES OF OPERATION**

**4.1 SUMMARY**

- A. The drawings indicate the individual types of systems and the points required in each system.
- B. System sequences of operation shall be as indicated on the drawings and as specified herein.

**END OF SECTION**

**SECTION 23 2113  
HYDRONIC PIPING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section includes pipe and fitting materials and joining methods for the following:
  - 1. Copper tube and fittings.
  - 2. Joining materials.
  - 3. Transition fittings.
  - 4. Dielectric fittings.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of the following:
  - 1. Pipe.
  - 2. Fittings.
  - 3. Joining materials.
- B. Delegated-Design Submittal:
  - 1. Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
  - 2. Locations of pipe anchors and alignment guides and expansion joints and loops.
  - 3. Locations of and details for penetrations, including sleeves and sleeve seals for exterior walls, floors, basement, and foundation walls.
  - 4. Locations of and details for penetration and firestopping for fire- and smoke-rated wall and floor and ceiling assemblies.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For Installer.
- B. Welding certificates.

**1.5 QUALITY ASSURANCE**

- A. Installer Qualifications:
  - 1. Installers of Pressure-Sealed Joints: Installers shall be certified by pressure-seal joint manufacturer as having been trained and qualified to join piping with pressure-seal pipe couplings and fittings.
  - 2. Fiberglass Pipe and Fitting Installers: Installers of RTRF and RTRP shall be certified by manufacturer of pipes and fittings as having been trained and qualified to join fiberglass piping with manufacturer-recommended adhesive.
- B. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
  - 1. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

**PART 2 - PRODUCTS**

**2.1 COPPER TUBE AND FITTINGS**

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

- B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.
- C. DWV Copper Tubing: ASTM B 306, Type DWV.
- D. Wrought-Copper Unions: ASME B16.22.

## **2.2 JOINING MATERIALS**

- A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- B. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

## **2.3 DIELECTRIC FITTINGS**

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
  - 1. Description:
    - a. Standard: ASSE 1079.
    - b. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
  - 1. Description:
    - a. Standard: ASSE 1079.
    - b. Factory-fabricated, bolted, companion-flange assembly.
    - c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

## **PART 3 - EXECUTION**

### **3.1 PIPING APPLICATIONS**

- A. Condensate-Drain Piping: Type M Type DWV, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

### **3.2 PIPING INSTALLATIONS**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

- M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- O. Install valves according to Section 230523 "Valves for HVAC Piping."
- P. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- Q. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- R. Install shutoff valve immediately upstream of each dielectric fitting.
- S. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.
- T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

### **3.3 DIELECTRIC FITTING INSTALLATION**

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
- C. Dielectric Fittings for NPS 2-1/2 and larger: Use dielectric flanges or flange kits.

### **3.4 HANGERS AND SUPPORTS**

- A. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hanger, support, and anchor devices. Comply with the following requirements for maximum spacing of supports.
- B. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
  - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
  - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
  - 4. Spring hangers to support vertical runs.
  - 5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
  - 1. NPS 3/4: Maximum span, 6 feet; minimum rod size, 1/4 inch.
  - 2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
  - 3. NPS 1-1/4: Maximum span, 6 feet; minimum rod size, 3/8 inch.
  - 4. NPS 1-1/2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
  - 5. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
  - 6. NPS 2-1/2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
  - 7. NPS 3 and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch.
- D. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

### **3.5 PIPE JOINT CONSTRUCTION**

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

- C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.

### **3.6 TERMINAL EQUIPMENT CONNECTIONS**

- A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

### **3.7 FIELD QUALITY CONTROL**

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
  - 1. Leave joints, including welds, uninsulated and exposed for examination during test.
  - 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
  - 3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
  - 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
  - 5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
- B. Perform the following tests on hydronic piping:
  - 1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
  - 2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
  - 3. Isolate expansion tanks and determine that hydronic system is full of water.
  - 4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure, but not less than 100 psig. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
  - 5. After hydrostatic test pressure has been applied for at least 15 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks for continuous 2 two hours.
  - 6. Prepare written report of testing.
- C. Perform the following before operating the system:
  - 1. Open manual valves fully.
  - 2. Inspect pumps for proper rotation.
  - 3. Set makeup pressure-reducing valves for required system pressure.
  - 4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
  - 5. Set temperature controls so all coils are calling for full flow.
  - 6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
  - 7. Verify lubrication of motors and bearings.

**END OF SECTION**

**SECTION 23 2300  
REFRIGERANT PIPING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Refrigerant pipes and fittings.
  - 2. Refrigerant piping valves and specialties.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of valve, refrigerant piping, and piping specialty.
  - 1. Include pressure drop, based on manufacturer's test data, for the following:
    - a. Thermostatic expansion valves.
    - b. Solenoid valves.
    - c. Filter dryers.
    - d. Strainers.
    - e. Pressure-regulating valves.
- B. Shop Drawings:
  - 1. Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes; flow capacities; valve arrangements and locations; slopes of horizontal runs; oil traps; double risers; wall and floor penetrations; and equipment connection details.
  - 2. Show piping size and piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
  - 3. Show interface and spatial relationships between piping and equipment.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Welding certificates.
- B. Field testing and inspection reports.

**1.5 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

**1.6 QUALITY ASSURANCE**

- A. Welding Qualifications: Qualify procedures and personnel according to 2010 ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

**1.7 PRODUCT STORAGE AND HANDLING**

- A. Store piping with end caps in place to ensure that piping interior and exterior are clean when installed.

**PART 2 - PRODUCTS**

**2.1 PERFORMANCE REQUIREMENTS**

- A. Line Test Pressure for Refrigerants shall be in accordance with the North Carolina Mechanical Code.

## 2.2 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B 88, Type L
- B. Wrought-Copper Fittings: ASME B16.22.
- C. Wrought-Copper Unions: ASME B16.22.
- D. Brazing Filler Metals: AWS A5.8/A5.8M.
- E. Flexible Connectors:
  - 1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
  - 2. End Connections: Socket ends.
  - 3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
  - 4. Working Pressure Rating: Factory test at minimum 500 psig.
  - 5. Maximum Operating Temperature: 250 deg F.

## 2.3 VALVES AND SPECIALTIES

- A. Diaphragm Packless Valves:
  - 1. Body and Bonnet: Forged brass or cast bronze; globe design with straight-through or angle pattern.
  - 2. Diaphragm: Phosphor bronze and stainless steel with stainless-steel spring.
  - 3. Operator: Rising stem and hand wheel.
  - 4. Seat: Nylon.
  - 5. End Connections: Socket, union, or flanged.
  - 6. Working Pressure Rating: 500 psig.
  - 7. Maximum Operating Temperature: 275 deg F.
- B. Packed-Angle Valves:
  - 1. Body and Bonnet: Forged brass or cast bronze.
  - 2. Packing: Molded stem, back seating, and replaceable under pressure.
  - 3. Operator: Rising stem.
  - 4. Seat: Nonrotating, self-aligning polytetrafluoroethylene.
  - 5. Seal Cap: Forged-brass or valox hex cap.
  - 6. End Connections: Socket, union, threaded, or flanged.
  - 7. Working Pressure Rating: 500 psig.
  - 8. Maximum Operating Temperature: 275 deg F.
- C. Check Valves:
  - 1. Body: Ductile iron, forged brass, or cast bronze; globe pattern.
  - 2. Bonnet: Bolted ductile iron, forged brass, or cast bronze; or brass hex plug.
  - 3. Piston: Removable polytetrafluoroethylene seat.
  - 4. Closing Spring: Stainless steel.
  - 5. End Connections: Socket, union, threaded, or flanged.
  - 6. Maximum Opening Pressure: 0.50 psig.
  - 7. Working Pressure Rating: 500 psig.
  - 8. Maximum Operating Temperature: 275 deg F.
- D. Service Valves:
  - 1. Body: Forged brass with brass cap including key end to remove core.
  - 2. Core: Removable ball-type check valve with stainless-steel spring.
  - 3. Seat: Polytetrafluoroethylene.
  - 4. End Connections: Copper spring.
  - 5. Working Pressure Rating: 500 psig.
- E. Solenoid Valves: Comply with AHRI 760 and UL 429; listed and labeled by a National Recognized Testing Laboratory (NRTL).
  - 1. Body and Bonnet: Plated steel.



2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice: Stainless steel.
  3. Seat: Polytetrafluoroethylene.
  4. End Connections: Threaded.
  5. Electrical: Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch conduit adapter, and ac coil, voltage as required.
  6. Working Pressure Rating: 400 psig.
  7. Maximum Operating Temperature: 240 deg F.
- F. Safety Relief Valves: Comply with 2010 ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
1. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
  2. Piston, Closing Spring, and Seat Insert: Stainless steel.
  3. Seat: Polytetrafluoroethylene.
  4. End Connections: Threaded.
  5. Working Pressure Rating: 400 psig.
  6. Maximum Operating Temperature: 240 deg F.
- G. Thermostatic Expansion Valves: Comply with AHRI 750.
1. Body, Bonnet, and Seal Cap: Forged brass or steel.
  2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
  3. Packing and Gaskets: Non-asbestos.
  4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
  5. Suction Temperature: As necessary.
  6. Superheat: Adjustable.
  7. Reverse-flow option (for heat-pump applications).
  8. End Connections: Socket, flare, or threaded union.
  9. Working Pressure Rating: As necessary.
- H. Straight-Type Strainers:
1. Body: Welded steel with corrosion-resistant coating.
  2. Screen: 100-mesh stainless steel.
  3. End Connections: Socket or flare.
  4. Working Pressure Rating: 500 psig.
  5. Maximum Operating Temperature: 275 deg F.
- I. Angle-Type Strainers:
1. Body: Forged brass or cast bronze.
  2. Drain Plug: Brass hex plug.
  3. Screen: 100-mesh monel.
  4. End Connections: Socket or flare.
  5. Working Pressure Rating: 500 psig.
  6. Maximum Operating Temperature: 275 deg F.
- J. Moisture/Liquid Indicators:
1. Body: Forged brass.
  2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
  3. Indicator: Color coded to show moisture content in parts per million (ppm).
  4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.
  5. End Connections: Socket or flare.
  6. Working Pressure Rating: 500 psig.
  7. Maximum Operating Temperature: 240 deg F.
- K. Replaceable-Core Filter Dryers: Comply with AHRI 730.
1. Body and Cover: Painted-steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets.
  2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.

3. Desiccant Media: Activated alumina or charcoal.
  4. Designed for reverse flow (for heat-pump applications).
  5. End Connections: Socket.
  6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
  7. Maximum Pressure Loss: 2 psig.
  8. Rated Flow: As necessary.
  9. Working Pressure Rating: 500 psig.
  10. Maximum Operating Temperature: 240 deg F.
- L. Mufflers:
1. Body: Welded steel with corrosion-resistant coating.
  2. End Connections: Socket or flare.
  3. Working Pressure Rating: 500 psig.
  4. Maximum Operating Temperature: 275 deg F.
- M. Receivers: Comply with AHRI 495.
1. Comply with 2010 ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.
  2. Comply with UL 207; listed and labeled by an NRTL.
  3. Body: Welded steel with corrosion-resistant coating.
  4. Tappings: Inlet, outlet, liquid level indicator, and safety relief valve.
  5. End Connections: Socket or threaded.
  6. Working Pressure Rating: 500 psig.
  7. Maximum Operating Temperature: 275 deg F.
- N. Liquid Accumulators: Comply with AHRI 495.
1. Body: Welded steel with corrosion-resistant coating.
  2. End Connections: Socket or threaded.
  3. Working Pressure Rating: 500 psig.
  4. Maximum Operating Temperature: 275 deg F.

### **PART 3 - EXECUTION**

#### **3.1 PIPING APPLICATIONS**

- A. Install all in accordance with refrigerant being used in the systems.
- B. Piping: Copper, Type L, drawn-temper tubing and wrought-copper fittings with brazed joints.

#### **3.2 VALVE AND SPECIALTY APPLICATIONS**

- A. Install valves in suction and discharge lines of compressor.
- B. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.
- C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.
- D. Except as otherwise indicated, install valves on inlet and outlet side of filter dryers.
- E. Install solenoid valves where necessary or required. Install solenoid valves in horizontal lines with coil at top.
- F. Install thermostatic expansion valves as close as possible to distributors on evaporators.
  1. Install valve so diaphragm case is warmer than bulb.
  2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
  3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.
- G. Install safety relief valves where required by 2010 ASME Boiler and Pressure Vessel Code. Pipe safety-relief-valve discharge line to outside according to ASHRAE 15.

- H. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.
- I. Install strainers where necessary or required unless they are furnished as an integral assembly for the device being protected:
- J. Install filter dryers in liquid line.
- K. Install receivers sized to accommodate pump-down charge.
- L. Install flexible connectors at compressors.

### 3.3 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Refer to drawings and Section 230900 "Direct Digital Control System" for solenoid valve controllers, control wiring, and sequence of operation.
- K. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- L. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Division 08 specifications if valves or equipment requiring maintenance is concealed behind finished surfaces.
- M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- N. Slope refrigerant piping as follows:
  - 1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
  - 2. Install horizontal suction lines with a uniform slope downward to compressor.
  - 3. Install traps and double risers to entrain oil in vertical runs.
  - 4. Liquid lines may be installed level.
- O. When brazing, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- P. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- Q. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."

- R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

### **3.4 PIPE JOINT CONSTRUCTION**

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Braze Joints: Construct joints according to AWS's "Braze Handbook," Chapter "Pipe and Tube."
  - 1. Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.
  - 2. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.

### **3.5 HANGERS AND SUPPORTS**

- A. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
  - 2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
  - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
  - 4. Spring hangers to support vertical runs.
  - 5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod diameters:
  - 1. NPS 3/4: Maximum span, 6 feet; minimum rod size, 1/4 inch.
  - 2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
  - 3. NPS 1-1/4: Maximum span, 6 feet; minimum rod size, 3/8 inch.
  - 4. NPS 1-1/2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
  - 5. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
  - 6. NPS 2-1/2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
  - 7. NPS 3 and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch.
- D. Support multifloor vertical runs at least at each floor.

### **3.6 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:
  - 1. Comply with ASME B31.5, Chapter VI.
  - 2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
    - a. Test in accordance with the North Carolina Mechanical Code.
    - b. Fill system with nitrogen to the required test pressure.
    - c. System shall maintain test pressure at the manifold gage throughout duration of test.
    - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

- B. Prepare test and inspection reports.

### **3.7 SYSTEM CHARGING**

- A. Charge system using the following procedures:
  - 1. Install core in filter dryers after leak test but before evacuation.
  - 2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
  - 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
  - 4. Charge system with a new filter-dryer core in charging line.

### **3.8 ADJUSTING**

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
  - 1. Open shutoff valves in condenser water circuit.
  - 2. Verify that compressor oil level is correct.
  - 3. Open compressor suction and discharge valves.
  - 4. Open refrigerant valves except bypass valves that are used for other purposes.
  - 5. Check open compressor-motor alignment and verify lubrication for motors and bearings.
- E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

**END OF SECTION**

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**SECTION 23 3113  
METAL DUCTS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Single-wall rectangular ducts and fittings.
  - 2. Single-wall round ducts and fittings.
  - 3. Double-wall round ducts and fittings.
  - 4. Sheet metal materials.
  - 5. Duct liner.
  - 6. Sealants and gaskets.
  - 7. Hangers and supports.
- B. Related Sections:
  - 1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
  - 2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of the following products:
  - 1. Single-wall round ducts and fittings.
  - 2. Double-wall round ducts and fittings.
  - 3. Liners and adhesives.
  - 4. Sealants and gaskets.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: A single set of plans or BIM model, drawn to scale, showing the items described in this Section and coordinated with all building trades.
- B. Welding certificates.
- C. Field quality-control reports.

**1.5 QUALITY ASSURANCE**

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
  - 2. AWS D9.1/D9.1M, "Sheet Metal Welding Code," for duct joint and seam welding.

**PART 2 - PRODUCTS**

**2.1 PERFORMANCE REQUIREMENTS**

- A. Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and with performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."

- D. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."
- E. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

## **2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS**

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
  - 1. Construct ducts of galvanized sheet steel unless otherwise indicated.
- B. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 1. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
  - 2. For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.
- C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## **2.3 SINGLE-WALL ROUND DUCTS AND FITTINGS**

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
  - 1. Construct ducts of galvanized sheet steel unless otherwise indicated.
  - 2. Subject to compliance with requirements, provide products by the following: McGill Airflow, Ductmate Industries, Linx Industries, or Eastern Sheetmetal.
- B. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."



**2.4 DOUBLE-WALL ROUND DUCTS AND FITTINGS**

- A. Subject to compliance with requirements, provide products by the following: McGill Airflow, Ductmate Industries, Linx Industries, or Eastern Sheetmetal.
- B. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch.3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.
  - 1. Construct ducts of galvanized sheet steel unless otherwise indicated.
  - 2. With paint grip finish.
- C. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 1. Transverse Joints in Ducts Larger Than 24 Inches in Diameter: Flanged.
- D. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- E. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- F. Diffuser, register, and grille openings shall be double wall internally insulated and made at the factory ready for the air distribution device.
- G. Inner Duct: Minimum 24-gauge perforated galvanized sheet steel having 3/32-inch-diameter perforations, with overall open area of 23 percent.
- H. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
  - 1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
  - 2. Insulation Thickness: 1 inch thick.
  - 3. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
  - 4. Coat insulation with antimicrobial coating.
  - 5. Cover insulation with polyester film complying with UL 181, Class 1.

**2.5 SHEET METAL MATERIALS**

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G90.
  - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Tie Rods: Galvanized steel, 1/4-inch-minimum diameter for lengths 36 inches or less; 3/8-inch-minimum diameter for lengths longer than 36 inches.

**2.6 DUCT LINER**

- A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Subject to compliance with requirements, provide products by the following: Certainteed, Owen Corning, Knauf, or Johns-Manville.
  2. Maximum Thermal Conductivity:
    - a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
  3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
  4. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
- B. Insulation Pins and Washers:
1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
  2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel; with beveled edge sized as required to hold insulation securely in place, but not less than 1-1/2 inches in diameter.
- C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."
1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
  2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
  3. Butt transverse joints without gaps, and coat joint with adhesive.
  4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
  5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
  6. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

## 2.7 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.
- B. Water-Based Joint and Seam Sealant:
1. Application Method: Brush on.
  2. Solids Content: Minimum 65 percent.
  3. Shore A Hardness: Minimum 20.
  4. Water resistant.
  5. Mold and mildew resistant.
  6. VOC: Maximum 75 g/L (less water).
  7. Maximum Static-Pressure Class: 10 inch wg, positive and negative.
  8. Service: Indoor or outdoor.
  9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- C. Flanged Joint Sealant: Comply with ASTM C 920.
1. General: Single-component, acid-curing, silicone, elastomeric.
  2. Type: S.
  3. Grade: NS.

4. Class: 25.
  5. Use: O.
- D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- E. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
  2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
  3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

## **2.8 HANGERS AND SUPPORTS**

- A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.
- B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- D. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- F. Trapeze and Riser Supports:
  1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

## **PART 3 - EXECUTION**

### **3.1 DUCT INSTALLATION**

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.
- B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install ducts in maximum practical lengths with fewest possible joints.
- D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- J. Install fire and smoke dampers where indicated on Drawings and as required by code, and by local authorities having jurisdiction. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers and specific installation requirements of the damper UL listing.

- K. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation. All open ends of ductwork shall be covered with self-adhesive 3 mil polyethylene film.
- M. Elbows: Use long-radius elbows wherever they fit.
  - 1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.
  - 2. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.
- N. Branch Connections: Use lateral or conical branch connections.

### **3.2 INSTALLATION OF EXPOSED DUCTWORK**

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

### **3.3 DUCT SEALING**

- A. Seal ducts at a minimum to the following seal classes in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
  - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 2. All Locations, All Ducts: Seal Class A, unless otherwise indicated.

### **3.4 HANGER AND SUPPORT INSTALLATION**

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
  - 1. Where practical, install concrete inserts before placing concrete.
  - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
  - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
  - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

### 3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

### 3.6 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

### 3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Duct System Cleanliness Tests:
  - 1. Visually inspect duct system to ensure that no visible contaminants are present.
  - 2. If cleanliness of ductwork is in question, test sections of metal duct system, chosen randomly by Owner, for cleanliness in accordance with "Description of Method 3 - NADCA Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
    - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
- C. Duct system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

### 3.8 STARTUP

- A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

### 3.9 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
  - 1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated below.
- B. Supply Ducts:
  - 1. Ducts Connected to Fan Coil Units, Heat Pumps, and Terminal Units:
    - a. Pressure Class: Positive 2-inch wg.
  - 2. Ducts Connected to Constant-Volume Air-Handling Units :
    - a. Pressure Class: Positive 2-inch wg.
  - 3. Ducts Connected to Variable-Air-Volume Air-Handling Units :
    - a. Pressure Class: Positive 3-inch wg.
- C. Exhaust Ducts:
  - 1. Ducts Connected to Air-Handling Units:
    - a. Pressure Class: Positive or negative 2- inch wg.
- D. Intermediate Reinforcement:
  - 1. Galvanized-Steel Ducts: Galvanized steel.
- E. Liner:
  - 1. Supply-Air Ducts where indicated on the drawings: Fibrous glass, Type I, 1 inch thick.
- F. Elbow Configuration:
  - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
    - a. Velocity 1000 fpm or Lower:
      - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.

- 2) Mitered Type RE 4 without vanes.
- b. Velocity 1000 to 1500 fpm:
  - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
  - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
  - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
- c. Velocity 1500 fpm or Higher:
  - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
  - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
  - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
  - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
  - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
  - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
  - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
    - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
    - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
    - 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
    - 4) Radius-to Diameter Ratio: 1.5.
- G. Branch Configuration:
  1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
    - a. Rectangular Main to Rectangular Branch: 45-degree entry.
    - b. Rectangular Main to Round Branch: 45-degree entry to round.
  2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
    - a. Velocity 1000 fpm or Lower: 90-degree tap.
    - b. Velocity 1000 to 1500 fpm: Conical tap.
    - c. Velocity 1500 fpm or Higher: 45-degree lateral.

**END OF SECTION**

**SECTION 23 3300  
AIR DUCT ACCESSORIES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Manual volume dampers.
  - 2. Control dampers.
  - 3. Fire dampers.
  - 4. Ceiling radiation dampers.
  - 5. Turning vanes.
  - 6. Duct-mounted access doors.
  - 7. Flexible connectors.
- B. Related Requirements:
  - 1. Section 233346 "Flexible Ducts" for insulated and non-insulated flexible ducts.
  - 2. Section 233723 "HVAC Gravity Ventilators" for roof-mounted ventilator caps.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

**1.4 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

**PART 2 - PRODUCTS**

**2.1 ASSEMBLY DESCRIPTION**

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

**2.2 MATERIALS**

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G90.
  - 2. Exposed-Surface Finish: Mill phosphatized.
- B. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

**2.3 MANUAL VOLUME DAMPERS**

- A. Low-Leakage, Steel, Manual Volume Dampers:
  - 1. Subject to compliance with requirements, provide products by the following: Ruskin CD36, Pottorff, Greenheck, or United Enertech.
  - 2. Comply with AMCA 500-D testing for damper rating.
  - 3. Low-leakage rating, maximum leakage shall be 0.5% at pressure differentials under 4.0 in w.g., with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

4. Suitable for horizontal or vertical applications.
  5. Frames:
    - a. Hat shaped.
    - b. 16-gauge, galvanized sheet steel.
    - c. Mitered and welded corners.
    - d. Flanges for attaching to walls and flangeless frames for installing in ducts.
  6. Blades:
    - a. Multiple or single blade.
    - b. Parallel- or opposed-blade design.
    - c. Stiffen damper blades for stability.
    - d. Galvanized, roll-formed steel, 16-gauge thick.
  7. Blade Axles: Plated steel.
  8. Bearings:
    - a. Molded synthetic.
    - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
  9. Blade Seals: PVC coated polyester.
  10. Jamb Seals: Cambered stainless steel
  11. Tie Bars and Brackets: Galvanized steel.
  12. Accessories:
    - a. Include locking device to hold single-blade dampers in a fixed position without vibration.
- B. Jackshaft:
1. Size: 0.5-inch diameter.
  2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
  3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.
- C. Damper Hardware:
1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
  2. Include center hole to suit damper operating-rod size.
  3. Include 2" stand-off elevated platform for insulated duct mounting.

## 2.4 CONTROL DAMPERS

- A. Subject to compliance with requirements, provide products by the following: Ruskin CD60, Pottorff, Greenheck, or United Enertech.
- B. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
- C. Frames:
1. Hat shaped.
  2. 16-gauge, galvanized sheet steel.
  3. Mitered and welded corners.
- D. Blades:
1. Multiple blade with maximum blade width of 6 inches.
  2. Parallel- and opposed-blade design.
  3. Galvanized-steel.
  4. 0.0747-inch-thick dual skin.
  5. Blade Edging: Closed-cell neoprene.
- E. Blade Axles: 1/2-inch-diameter; plated steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
1. Operating Temperature Range: From minus 40 to plus 200 deg F.



- F. Bearings:
  - 1. Stainless-steel sleeve.
  - 2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
  - 3. Thrust bearings at each end of every blade.

## **2.5 FIRE DAMPERS**

- A. Subject to compliance with requirements, provide products by the following: Ruskin, Pottorff, Greenheck, or United Enertech.
- B. Type: Dynamic; rated and labeled according to UL 555 by an NRTL.
- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.
- D. Fire Rating: 1-1/2 and 3 hours.
- E. Frame: Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.
- F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
  - 1. Minimum Thickness: As required, and of length to suit application.
  - 2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
- G. Mounting Orientation: Vertical or horizontal as indicated.
- H. Blades: Roll-formed, interlocking, 24-gauge thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch-thick, galvanized-steel blade connectors.
- I. Closure Spring: Stainless steel.
- J. Horizontal Dampers: Include blade lock.
- K. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

## **2.6 CEILING RADIATION DAMPERS**

- A. Subject to compliance with requirements, provide products by the following: Ruskin, Pottorff, Greenheck, or United Enertech.
- B. General Requirements:
  - 1. Labeled according to UL 555C by an NRTL.
  - 2. Comply with construction details for tested floor- and roof-ceiling assemblies as indicated in UL's "Fire Resistance Directory."
- C. Frame: Galvanized sheet steel, round or rectangular, style to suit ceiling construction or installation in diffuser, grille, or register.
- D. Blades: Galvanized sheet steel with refractory insulation.
- E. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.
- F. Include refractory blanket as necessary for installation on diffuser, grille, or register.
- G. Fire Rating: 1 hours.

## **2.7 TURNING VANES**

- A. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- B. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."
- C. Vane Construction: Double wall.

## 2.8 DUCT-MOUNTED ACCESS DOORS

- A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."
  1. Door:
    - a. Double wall, rectangular.
    - b. Galvanized sheet metal with 1" insulation fill and thickness as indicated for duct pressure class.
    - c. Hinges and Latches: 1-by-1-inchbutt or piano hinge and cam latches.
    - d. Fabricate doors airtight and suitable for duct pressure class.
  2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
  3. Number of Hinges and Locks:
    - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
    - b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
    - c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
    - d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

## 2.9 FLEXIBLE CONNECTORS

- A. Materials: Flame-retardant or noncombustible fabrics.
- B. Coatings and Adhesives: Comply with UL 181, Class 1.
- C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.
- D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
  1. Minimum Weight: 26 oz./sq. yd.
  2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
  3. Service Temperature: Minus 40 to plus 200 deg F.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install manual volume dampers at points on supply, return, and exhaust systems where indicated on the drawings and as determined by testing, adjusting, and balancing. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
- D. Set dampers to fully open position before testing, adjusting, and balancing.
- E. Install test holes at fan inlets and outlets and elsewhere as indicated.
- F. Install fire dampers, ceiling radiation dampers, and combination smoke/fire dampers according to UL listing.
- G. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
  1. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.

2. Adjacent to and close enough to fire dampers and combination smoke/fire dampers to reset or reinstall fusible links and observe operation. Access doors for access to fire dampers and combination smoke/fire dampers shall be outward operation.
  3. Control devices requiring inspection.
  4. Elsewhere as indicated.
- H. Install access doors with swing against duct static pressure.
- I. Access Door Sizes:
1. 16" x 20" or two inches less than the height of the duct.
- J. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- K. Install flexible connectors to connect ducts to equipment.
- L. Connect diffusers to ducts directly or with maximum 96-inch lengths of flexible duct clamped or strapped in place.
- M. Connect flexible ducts to metal ducts with draw bands plus tape.
- N. Install duct test holes where required for testing and balancing purposes.
- 3.2 FIELD QUALITY CONTROL**
- A. Tests and Inspections:
1. Operate dampers to verify full range of movement.
  2. Inspect locations of access doors and verify that purpose of access door can be performed.
  3. Operate fire, smoke, ceiling radiation dampers, and combination smoke/fire dampers to verify full range of movement and verify that proper heat-response device is installed.
  4. Inspect turning vanes for proper and secure installation.
  5. Operate remote damper operators to verify full range of movement of operator and damper.

**END OF SECTION**

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**SECTION 23 3346  
FLEXIBLE DUCTS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Insulated flexible ducts.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

**PART 2 - PRODUCTS**

**2.1 ASSEMBLY DESCRIPTION**

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- C. Comply with the Air Diffusion Council's "ADC Flexible Air Duct Test Code FD 72-R1."
- D. Comply with ASTM E 96/E 96M, "Test Methods for Water Vapor Transmission of Materials."

**2.2 INSULATED FLEXIBLE DUCTS**

- A. Insulated, Flexible Duct: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.
  - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
  - 2. Maximum Air Velocity: 4000 fpm.
  - 3. Temperature Range: Minus 20 to plus 210 deg F.
  - 4. Insulation R-Value: Comply with ASHRAE/IES 90.1 R6.

**2.3 FLEXIBLE DUCT CONNECTORS**

- A. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.
- B. Non-Clamp Connectors: Draw bands plus tape.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Install flexible ducts according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install in indoor applications only. Flexible ductwork should not be exposed to UV lighting.
- C. Connect diffusers to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- D. Connect flexible ducts to metal ducts with draw bands plus tape.
- E. Install duct test holes where required for testing and balancing purposes.
- F. Installation:
  - 1. Install ducts fully extended.
  - 2. Do not bend ducts across sharp corners.

3. Bends of flexible ducting shall not exceed a minimum of one duct diameter.
  4. Avoid contact with metal fixtures, water lines, pipes, or conduits.
  5. Install flexible ducts in a direct line, without sags, twists, or turns.
- G. Supporting Flexible Ducts:
1. Suspend flexible ducts with bands 1-1/2 inches wide or wider and spaced a maximum of 48 inches apart. Maximum centerline sag between supports shall not exceed 1/2 inch per 12 inches.
  2. Flexible ducts shall have a minimum of one support.
  3. Install extra supports at bends placed approximately one duct diameter from center line of the bend.
  4. Vertically installed ducts shall be stabilized by support straps at a maximum of 72 inches o.c.
- H. Duct Schedule:
1. All flexible ducts shall be insulated type, except where noted otherwise.

**END OF SECTION**

**SECTION 23 3423  
HVAC POWER VENTILATORS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Centrifugal roof ventilators.
  - 2. Ceiling-mounted ventilators.
  - 3. In-line centrifugal fans.
  - 4. Propeller fans.

**1.3 PERFORMANCE REQUIREMENTS**

- A. Operating Limits: Classify according to AMCA 99.

**1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:
  - 1. Certified fan performance curves with system operating conditions indicated.
  - 2. Certified fan sound-power ratings.
  - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
  - 4. Material thickness and finishes, including color charts.
  - 5. Dampers, including housings, linkages, and operators.
  - 6. Roof curbs.
  - 7. Fan speed controllers.

**1.5 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

**1.6 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.
- C. UL Standards: Power ventilators shall comply with UL 507 or UL 705 as applicable. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

**1.7 COORDINATION**

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided.
- C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

**PART 2 - PRODUCTS**

**2.1 PERFORMANCE REQUIREMENTS**

- A. Structural Performance: Ventilators shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of ventilator components, noise or metal fatigue caused by ventilator blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
  - 1. Wind Loads: Per installation Region per the Building Code.

**2.2 CENTRIFUGAL ROOF VENTILATORS**

- A. Subject to compliance with requirements, provide products by the following: Greenheck, Loren Cook, Carnes, Twin City, or PennBarry.
- B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.
  - 1. Downblast Units: Provide spun-aluminum discharge baffle to direct discharge air downward.
  - 2. Upblast Units where indicated on the drawings: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains.
  - 3. Fan and motor isolated from exhaust airstream.
  - 4. Finish:
    - a. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Treat as necessary for coating to be applied over it.
    - b. Factory Anodized aluminum finish.
- C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.
- D. Accessories:
  - 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
  - 2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
  - 3. Bird Screens: Removable, 1/2-inch mesh, stainless steel.
  - 4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
    - a. Dampers shall have an air leakage rate not greater than 20 cfm/sq ft where not less than 24 inches in either dimension and 40 cfm/sq ft where less than 24 inches in either dimension. The rate of air leakage shall be determined at 1.0 inch water gauge when tested in accordance with AMCA 500D for such purpose.
- E. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch-thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.
  - 1. Configuration: Built-in raised cant and mounting flange.
  - 2. Overall Height: 12 inches above finished roof.
  - 3. Finish: To match power ventilator.

**2.3 CEILING-MOUNTED VENTILATORS**

- A. Subject to compliance with requirements, provide products by the following: Greenheck, Loren Cook, Carnes, Twin City, or PennBarry.
- B. Housing: Steel, lined with acoustical insulation.
- C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.
- D. Grille: Plastic, louvered grille with flange on intake and thumbscrew attachment to fan housing.
- E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.
- F. Accessories:
  - 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
  - 2. Dampers: Counterbalanced, backdraft damper; factory set to close when fan stops.
    - a. Dampers shall have an air leakage rate not greater than 20 cfm/sq ft where not less than 24 inches in either dimension and 40 cfm/sq ft where less than 24 inches in either dimension. The rate of air leakage shall be determined at 1.0 inch water gauge when tested in accordance with AMCA 500D for such purpose.



3. Manufacturer's standard wall cap, and transition fittings.
  - a. Baked-Enamel Finish: Factory applied manufacturer's standard finish consisting of prime coat and thermosetting topcoat, color and gloss as selected by Architect from manufacturer's full range.

## 2.4 IN-LINE CENTRIFUGAL FANS

- A. Subject to compliance with requirements, provide products by the following: Greenheck, Loren Cook, Carnes, Twin City, or PennBarry.
- B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.
- C. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.
- D. Fan Wheels: Aluminum, backward inclined.
- E. Accessories:
  1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
  2. Companion Flanges: For inlet and outlet duct connections.
  3. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
  4. Dampers: Counterbalanced, parallel-blade, backdraft dampers; factory set to close when fan stops.
    - a. Dampers shall have an air leakage rate not greater than 20 cfm/sq ft where not less than 24 inches in either dimension and 40 cfm/sq ft where less than 24 inches in either dimension. The rate of air leakage shall be determined at 1.0 inch water gauge when tested in accordance with AMCA 500D for such purpose.
5. Vibration Isolators: Elastomeric hangers

## 2.5 PROPELLER FANS

- A. Subject to compliance with requirements, provide products by the following: Greenheck, Loren Cook, Carnes, Twin City, or PennBarry.
- B. Housing: Galvanized-steel sheet with flanged edges and integral orifice ring with baked-enamel finish coat applied after assembly.
- C. Steel Fan Wheels: Formed-steel blades riveted to heavy-gage steel spider bolted to cast-iron hub.
- D. Fan Wheel: Replaceable, aluminum, airfoil blades fastened to cast-aluminum hub; factory set pitch angle of blades.
- E. Fan Drive: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.
- F. Fan Drive:
  1. Resiliently mounted to housing.
  2. Statically and dynamically balanced.
  3. Selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
  4. Extend grease fitting to accessible location outside of unit.
  5. Service Factor Based on Fan Motor Size: 1.4.
  6. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
  7. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
    - a. Ball-Bearing Rating Life: ABMA 9, L 50 in excess of 200,000 hours.
  8. Pulleys: Cast iron with split, tapered bushing; dynamically balanced at factory.
  9. Motor Pulleys: Adjustable pitch for use with motors through [5] <insert value> hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.

10. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
11. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.

G. Accessories:

1. Gravity Shutters: Aluminum blades in aluminum frame; interlocked blades with nylon bearings.
  - a. Dampers shall have an air leakage rate not greater than 20 cfm/sq ft where not less than 24 inches in either dimension and 40 cfm/sq ft where less than 24 inches in either dimension. The rate of air leakage shall be determined at 1.0 inch water gauge when tested in accordance with AMCA 500D for such purpose.
2. Motor-Side Back Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.
3. Wall Sleeve: Galvanized steel to match fan and accessory size.
4. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
5. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.

H. Capacities and Characteristics:

1. Vibration Isolators:
  - a. Type: Elastomeric hangers.
  - b. Static Deflection: 1 inch.

## 2.6 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
  1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

## 2.7 SOURCE QUALITY CONTROL

- A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Equipment Mounting:
  1. Comply with requirements for vibration isolation devices specified in Section 230549 "Vibration Controls for HVAC."
- C. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
- D. Install units with clearances for service and maintenance.
- E. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

### 3.2 CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories.
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

- D. Connect wiring according to Section 260519 "Conductors and Cables."

### **3.3 FIELD QUALITY CONTROL**

- A. Tests and Inspections:
  - 1. Verify that shipping, blocking, and bracing are removed.
  - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
  - 3. Verify that cleaning and adjusting are complete.
  - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
  - 5. Adjust damper linkages for proper damper operation.
  - 6. Verify lubrication for bearings and other moving parts.
  - 7. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
  - 8. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
  - 9. Shut unit down and reconnect automatic temperature-control operators.
  - 10. Remove and replace malfunctioning units and retest as specified above.
- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

### **3.4 ADJUSTING**

- A. Adjust damper linkages for proper damper operation.
- B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- C. Replace fan and motor pulleys as required to achieve design airflow.
- D. Lubricate bearings.

**END OF SECTION**

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**SECTION 23 3713  
AIR DIFFUSERS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Diffusers
- B. Related Requirements:
  - 1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers.
  - 2. Section 233714 "Registers and Grilles" for adjustable-bar register and grilles, fixed-face registers and grilles, and linear bar grilles.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
  - 2. Diffuser Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

**PART 2 - PRODUCTS**

**2.1 DIFFUSERS**

- A. Subject to compliance with requirements, provide products by the following: Carnes, Metal Aire, Titus, Krueger, or Price. All diffusers shall have a maximum NC level of 25 in the space for the specific airflow
- B. Lay-in Ceiling Supply Air Diffuser (Aluminum):
  - 1. Type: Aluminum fixed square louvered face, 4 way blow with baked white enamel finish unless indicated on the drawings to be field painted. White factory finish shall be necessary to receive field finish painting. Final color selected by the architect.
  - 2. Panel border to drop in a 24"x24" "T" bar ceiling grid, with an adjustable vertical pattern. Vertical air adjustment shall be made by adjusting 4 perimeter blades to force air down in a vertical position.
  - 3. Provide a square to round adapter.
  - 4. Diffusers shall be steel where installed with radiation dampers.
- C. Ceiling Supply Air Slot Diffuser:
  - 1. Type: Heavy duty extruded aluminum bar blades locked into extruded aluminum border. Boarder and core to have baked powder coat finish, color selected by Architect. Core is fixed and core bars to run the long dimension.
  - 2. Multiple units supplied complete with alignment splice plates.
  - 3. Horizontal Face with integral core construction and 1/2" blade spacing and 15° deflection with reinforced support bars. See mechanical schedule for size.
  - 4. Border Frame is 1" heavy duty extruded aluminum and provide precision factory mitered corners and concealed mounting.
  - 5. Provide cable operated opposed blade damper.
  - 6. Provide insulated plenum box the full size and length of the grille.
  - 7. Return air slot to be same as supply.
- D. Ceiling Supply Air Diffuser (Aluminum):
  - 1. Type: Aluminum fixed square louvered face, 4 way blow with baked white enamel finish unless indicated on the drawings to be field painted. White factory finish shall be necessary to receive field finish painting. Final color selected by the architect.
  - 2. Border provided for surface mounted installation,
  - 3. Diffuser with an adjustable vertical pattern. Vertical air adjustment shall be made by adjusting 4 perimeter blades to force air down in a vertical position.

4. Provide a square to round adapter.
  5. Diffusers shall be steel where installed with radiation dampers.
- E. Verification of Performance: Rate diffusers according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine areas where diffusers are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

#### **3.2 INSTALLATION**

- A. Install diffusers level and plumb. Provide supports at the corners of the diffusers and grilles per the ceiling manufacturers' installation instructions.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

#### **3.3 ADJUSTING**

- A. After installation, adjust diffusers to air patterns indicated, or as directed, before starting air balancing.

**END OF SECTION**

**SECTION 23 3714  
REGISTERS AND GRILLES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Registers
  - 2. Grilles
- B. Related Requirements:
  - 1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to registers and grilles.
  - 2. Section 233713 "Air Diffusers" for various types of air diffusers.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
  - 2. Register and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

**PART 2 - PRODUCTS**

**2.1 REGISTERS**

- A. Subject to compliance with requirements, provide products by the following: Carnes, Metal Aire, Titus, Krueger, or Price. All registers and grilles shall have a maximum NC level of 25 in the space for the specific airflow.
- B. Sidewall Supply Air Register with fixed blades and OBD :
  - 1. Type: Steel with baked white enamel finish unless indicated on the drawings to be field painted. White factory finish shall be necessary to receive field finish painting. Final color selected by the Architect.
  - 2. Horizontal Face Blade with integral core construction and 3/4" blade spacing and 45° deflection with 1-way blow.
  - 3. Border Frame is 1-1/4" flat standard with countersunk screwholes.
  - 4. Provide opposed blade damper.
  - 5. See mechanical schedule for size.
- D. Spiral Duct Supply Register (Aluminum):
  - 1. Type: Double deflection individually adjustable blades, front blades parallel to short dimension.
  - 2. Aluminum blades on 3/4" blade spacing.
  - 3. Border Frame is welded aluminum 1-1/4" flat standard with countersunk screwholes.
  - 4. Provide frame for mounting in spiral ductwork.
  - 5. Provide an air scoop for balancing.
  - 6. White factory finish shall be necessary to receive field finish painting. Final color selected by the architect.
  - 7. See mechanical schedule for size.
- C. Lay-in Return Air Egg Crate Register:
  - 1. Type: Aluminum fixed 1/2" x 1/2" egg crate with steel frame. Shall be full flow across the entire face of the grille and tapered up to the neck size. (See schedule for size).
  - 2. White factory finish shall be necessary to receive field finish painting. Final color selected by the architect.
  - 3. Lay in Egg Crate Return to drop in a 24"x24" "T" bar ceiling grid (See schedule for size).
  - 4. Provide opposed blade damper.
  - 5. Register shall be steel construction where installed with radiation damper.

D. Ceiling Return Air Egg Crate Register:

1. Type: Aluminum fixed 1/2" x 1/2" egg crate with steel frame. Register shall be full flow across the entire face of the register and tapered up to the neck size.
2. Border Frame is 1-1/4" flat standard with countersunk screwholes.
3. White factory finish shall be necessary to receive field finish painting. Final color selected by the architect.
4. Provide opposed blade damper.
5. Register shall be steel construction where installed with radiation damper.
6. See mechanical schedule for size.

E. Ceiling Exhaust Air Register:

1. Type: Aluminum fixed blades
2. White factory finish shall be necessary to receive field finish painting. Final color selected by the Architect.
3. Horizontal Face Blade with all welded face bars and 1/2" blade spacing and 35° deflection. Face Bars shall be 1/8" thick with rounded edges. Blades to run long horizontal dimension.
4. Border Frame is 1-1/4" flat standard with countersunk screwholes.
5. Provide square to round adapter.
6. Provide opposed blade damper.
7. Register shall be steel construction where installed with radiation damper.
8. See mechanical schedule for size.

F. Sidewall Return Air Registers (Steel):

1. Type: Heavy Duty Steel with baked white enamel finish unless indicated on the drawings to be field painted. White factory finish shall be necessary to receive field finish painting. Final color selected by the architect.
2. Horizontal Face Blade with all welded face bars and 1/2" blade spacing and 40° deflection. Face Bars shall be 1/8" thick with rounded edges. Blades to run long horizontal dimension.
3. Border Frame is 1-1/4" flat standard with countersunk screwholes.
4. See mechanical schedule for size.

G. Sidewall Exhaust Air Register:

1. Type: Aluminum fixed blades
2. White factory finish shall be necessary to receive field finish painting. Final color selected by the Architect.
3. Horizontal Face Blade with all welded face bars and 1/2" blade spacing and 35° deflection. Face Bars shall be 1/8" thick with rounded edges. Blades to run long horizontal dimension.
4. Border Frame is 1-1/4" flat standard with countersunk screwholes.
5. Provide square to round adapter.
6. Provide opposed blade damper.
7. See mechanical schedule for size.

## 2.2 GRILLES

A. Sidewall Return Air Grille:

1. Type: Heavy Duty Aluminum with baked white enamel finish unless indicated on the drawings to be field painted. White factory finish shall be necessary to receive field finish painting. Final color selected by the architect.
2. Horizontal Face Blade with all welded face bars and 3/4" blade spacing and 45° deflection. Face Bars shall be 1/8" thick with rounded edges. Blades to run long horizontal dimension.
3. Border Frame is 1-1/4" flat standard with countersunk screwholes.
4. See mechanical schedule for size.

B. Sidewall Linear Bar Grille (Aluminum):



1. Type: Aluminum extruded heavy duty bar blades locked into extruded aluminum border.
2. Grille factory finish shall be baked enamel of color selected by Architect. Border and blade factory finish shall be powder coat.
3. Blades shall be fixed 30° deflection on 1/2" centers running parallel to the long dimension of the grille with reinforcing support bars.
4. Border shall be 1" width suitable for sidewall mounting complete with precise factory mitered corners and concealed mounting.
5. See mechanical schedule for size.

**2.3 SOURCE QUALITY CONTROL**

- A. Verification of Performance: Rate registers and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Examine areas where registers and grilles are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

**3.2 INSTALLATION**

- A. Install registers and grilles level and plumb.
- B. Provide extra hangers at the corners of grilles and registers as required by the ceiling manufacturer's installation instructions.
- C. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- D. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

**3.3 ADJUSTING**

- A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

**END OF SECTION**

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**SECTION 23 3723  
HVAC GRAVITY VENTILATORS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Louvered-penthouse ventilators.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

**1.4 COORDINATION**

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

**PART 2 - PRODUCTS**

**2.1 PERFORMANCE REQUIREMENTS**

- A. Structural Performance: Ventilators shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of ventilator components, noise or metal fatigue caused by ventilator blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
  - 1. Wind Loads: Per installation Region per the Building Code.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.
- C. Water Entrainment: Limit water penetration through unit to comply with ASHRAE 62.1.

**2.2 FABRICATION**

- A. Factory or shop fabricate gravity ventilators to minimize field splicing and assembly. Disassemble units to the minimum extent as necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.
- B. Fabricate frames, including integral bases, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- C. Fabricate units with closely fitted joints and exposed connections accurately located and secured.
- D. Fabricate supports, anchorages, and accessories required for complete assembly.
- E. Perform shop welding by AWS-certified procedures and personnel.

**2.3 LOUVERED-PENTHOUSE VENTILATORS**

- A. Description: Multitier rectangular louvered penthouse.
- B. Subject to compliance with requirements, provide products by the following: Greenheck, Loren Cook, Carnes, or United Enertech.
- C. Source Limitations: Obtain louvered-penthouse ventilators from single manufacturer.
- D. Construction:
  - 1. Material: All-welded assembly with 4-inch-deep louvers, mitered corners, and aluminum sheet roof.

2. Frame and Blade Material: Extruded aluminum, of thickness required to comply with structural performance requirements, but not less than 0.080 inch for frames and 0.080 inch for blades.
3. Insulation: Mineral-fiber insulation and vapor barrier.
4. Vertical snow and storm baffle at base.
5. Bird Screening: Stainless-steel, 1/2-inch-square mesh wire.
6. Finish:
  - a. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Treat as necessary for coating to be applied over it.
  - b. Factory Anodized aluminum finish.
- E. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch-thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to fit roof opening and ventilator base.
  1. Configuration: Built-in raised cant and mounting flange.
  2. Overall Height: 12 inches above finished roof.
  3. Finish: To match gravity ventilator.

## **2.4 MATERIALS**

- A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5 or T-52.
- B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005, with temper as required for forming or as otherwise recommended by metal producer for required finish.
- C. Fasteners: Same basic metal and alloy as fastened metal or 300 Series stainless steel unless otherwise indicated. Do not use metals that are incompatible with joined materials.
  1. Use types and sizes to suit unit installation conditions.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install gravity ventilators level, plumb, and at indicated alignment with adjacent work.
- B. Secure gravity ventilators to roof curbs with stainless steel hardware with EPDM washers, that comply with the wind fastening requirements.
- C. Install gravity ventilators with clearances for service and maintenance.
- D. Install perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Install concealed gaskets, flashings, joint fillers, and insulation as installation progresses. Comply with Section 079200 "Joint Sealants" for sealants applied during installation.
- F. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes, so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.
- G. Refer to Section 077200 "Roof Accessories" for flashing and counterflashing of roof curbs.

### **3.2 CONNECTIONS**

- A. Duct installation and connection requirements are specified in Section 233113 "Metal Ducts" and Section 233116 "Nonmetal Ducts." Drawings indicate general arrangement of ducts and duct accessories.

### **3.3 ADJUSTING**

- A. Adjust damper linkages for proper damper operation.

## **END OF SECTION**

**SECTION 234100  
PARTICULATE AIR FILTRATION**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Pleated panel filters.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product. Include dimensions; operating characteristics; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each model indicated.

**1.4 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For each type of filter and rack to include in emergency, operation, and maintenance manuals.

**1.5 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Provide sets of filters for each system as necessary during construction, a clean set for TAB, a clean set at final occupancy, and one additional set of filters as Owner stock. If system includes prefilters, include prefilters.

**1.6 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: An NRTL.

**1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver and store products in a clean, dry place.
- B. Comply with manufacturer's written rigging and installation instructions for unloading and moving to final installed location.
- C. Handle products carefully to prevent damage, breaking, denting, and scoring. Do not install damaged products.
- D. Protect products from weather, dirt, dust, water, construction debris, and physical damage.
  - 1. Retain factory-applied coverings on equipment to protect finishes during construction and remove just prior to operating unit.
  - 2. Cover unit openings before installation to prevent dirt and dust from entering inside of units. If required to remove coverings during unit installation, reapply coverings over openings after unit installation and remove just prior to operating unit.
  - 3. Replace installed products damaged during construction.

**PART 2 - PRODUCTS**

**2.1 PERFORMANCE REQUIREMENTS**

- A. ASHRAE Compliance:
  - 1. Comply with ASHRAE 52.2 for MERV for methods of testing and rating air-filter units.
- B. Comply with NFPA 90A and NFPA 90B.
- C. Comply with UL 900.

## **2.2 PLEATED PANEL FILTERS**

- A. Description: Factory-fabricated, self-supported, extended-surface, pleated, panel-type, disposable air filters with holding frames.
- B. Source Limitations: Obtain from single source from single manufacturer.
- C. Capacities and Characteristics:
  - 1. Face Size: As required.
  - 2. Depth: 1-, 2- or 4-inches nominal, as required by equipment.
  - 3. Number of Filters, Wide by High: As required.
  - 4. Maximum Face Velocity: 515 fpm.
  - 5. Minimum Efficiency Reporting Value: MERV 13, with "Composite Average Particle Size Efficiency, Percent in Size Range, Micrometers" according to ASHRAE 52.2.
- D. Media: Synthetic fibers coated with nonflammable adhesive.
  - 1. Separators shall be bonded to the media to maintain pleat configuration.
  - 2. Welded-wire grid shall be on downstream side to maintain pleat.
  - 3. Media shall be bonded to frame to prevent air bypass.
- E. Filter-Media Frame: Double wall cardboard frame sealed or bonded to the media.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine ducts, air-handling units, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION OF FILTERS**

- A. Install filters in position to prevent passage of unfiltered air.
- B. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.
- C. Coordinate filter installations with duct and air-handling-unit installations.
- D. Provide complete sets of filters as necessary to protect equipment during construction, another change of filters at completion, and leave one additional complete set of filters per Maintenance Material Submittals requirements.

### **3.3 FIELD QUALITY CONTROL**

- A. Tests and Inspections:
  - 1. Test for leakage of unfiltered air while system is operating.

### **3.4 CLEANING**

- A. After completing system installation and testing, adjusting, and balancing of air-handling and air-distribution systems, clean filter housings and install new filter media.

**END OF SECTION**

**SECTION 23 7223**  
**PACKAGED INDOOR FIXED PLATE ENERGY RECOVERY UNITS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Fixed-plate, total heat exchangers in packaged, indoor, energy-recovery units.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include packaged, indoor, fixed-plate, energy-recovery unit rated capacities, operating characteristics, furnished specialties, and accessories.
  - 2. Fans:
    - a. Certified fan-performance curves with system operating conditions indicated.
    - b. Certified fan-sound power ratings.
    - c. Fan construction and accessories.
    - d. Motor ratings, electrical characteristics, and motor accessories.
- B. Packaged, indoor, fixed-plate, energy-recovery units.
  - 1. Include plans, elevations, sections, details, and mounting details.
  - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Include diagrams for power, signal, and control wiring.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Floor plans, elevations, and other details, drawn to scale. and coordinated with each other, using input from installers of the items involved.
- B. Seismic Qualification Data: Certificates, for packaged, indoor, fixed-plate, energy-recovery units, accessories, and components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.

**1.5 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For air-to-air energy recovery equipment to include in maintenance manuals.

**1.6 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Filters: Provide sets of filters for each system as necessary during construction, a clean set for TAB, a clean set at final occupancy, and one additional set of filters as Owner stock. If system includes prefilters, include prefilters.
  - 2. Fan Belts: One set of belts for each belt-driven fan in energy recovery units.

**1.7 COORDINATION**

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

**1.8 WARRANTY**

- A. Special Warranty: Manufacturer agrees to repair or replace components of packaged, indoor, fixed-plate, energy-recovery units that fail in materials or workmanship within specified warranty period.
  - 1. For Parts: One year(s) from date of Final Acceptance.
  - 2. For Labor: One year(s) from date of Final Acceptance.

**PART 2 - PRODUCTS**

**2.1 PERFORMANCE REQUIREMENTS**

- A. UL Compliance:
  - 1. Packaged heat-recovery ventilators shall comply with requirements in UL 1812 or UL 1815.
- B. AHRI Compliance:
  - 1. Static core heat exchanger rated in accordance with AHRI Standard 1060-2000 with ratings certified by AHRI.
- C. Comply with UL 723.

**2.2 PACKAGED, INDOOR, FIXED-PLATE TOTAL ENERGY RECOVERY UNITS**

- A. Manufacturers
  - 1. Subject to compliance with requirements, provide products by the following: Ruskin, Greenheck, ECV, or approved equal.
- A. Housing:
  - 1. Casing: Fully insulated 20-gauge galvanized steel.
  - 2. Powder coat paint finish electrostatically bonded to the metal.
  - 3. Top access doors and movable duct flanges for intake air and exhaust air duct connections.
  - 4. All airstreams shall be horizontal.
  - 5. Knockouts shall be provided for power connections.
  - 6. Hanging or pad mount installation capability shall be standard.
  - 7. Test ports shall be provided so airflow can be measured across the energy recovery device.
- B. Static-Core Total Heat Exchanger:
  - 1. Casing: Core shall be built into an aluminum frame.
  - 2. Core shall be coated with a polymer membrane without the use of binders or adhesives which may plug the desiccant aperture.
  - 3. Desiccant shall not dissolve or deliquesce in the presence of water or high humidity.
  - 4. The core shall be easily cleanable with a standard cleaning solution or mild soap and water solution.
  - 5. The core shall have a crossover exhaust air transfer ration < 0.5% and shall accommodate a low-pressure drop of 0.35 in w.g @ 100% rated CFM.
  - 6. The air transfer shall happen without virus transfer and shall be compliant with ASTM F-1671 for zero penetration.
  - 7. The core also shall be mold and bacteria resistant (ISO 846 – Rating 0).
- C. Supply and Exhaust Fans:
  - 1. Forward-curved centrifugal forward curved blowers.
  - 2. Ball bearings and three-speed direct drive permanent split capacitor motors.
  - 3. Provide speed controller for each fan motor.
- D. Filters:
  - 1. Description: 2" thick UL Class 1 pleated panels with Minimum Efficiency Reporting Value/MERV 13 per ASHRAE Standard 52.2-2012.



2. The contractor shall supply complete sets of filters to protect his equipment during construction, another change of filters at completion, and leave one additional complete set of filters at the building for the next change.
  3. Provide factory supplied fixed filter block offs to prevent air bypass around filters
- E. Wiring: Fabricate units with space within housing for electrical conduits. Wire motors and controls, so only external connections are required during installation.
1. Indoor Enclosure: NEMA 250, Type 12 enclosure contains relays, starters, and terminal strip.
  2. Include non-fused disconnect switches.

### **2.3 CONTROLS**

- A. Control Panel: Solid-state, programmable, microprocessor-based control unit for wall mounting in mechanical mezzanine. Integrate to BACnet as specified in Section 230900 "Instrumentation and Control for HVAC".
- B. Starting relay, factory mounted and wired, and manual motor starter for field wiring.
- C. Differential pressure sensors for airflow status monitoring.
- D. Dirty filter switch.
- E. Low-Voltage Transformer: Integral transformer to provide control voltage to unit from primary incoming electrical service.

### **2.4 SOURCE QUALITY CONTROL**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- B. AHRI Compliance: Capacity ratings for air-to-air energy-recovery equipment certified as complying with AHRI 1060.
- C. Fan Performance Rating: Comply with AMCA 211 and label fans with AMCA-certified rating seal. Factory test fan performance for airflow, pressure, power, air density, rotation speed, and efficiency according to AMCA 210/ASHRAE 51.
- D. Fan Sound Ratings: Comply with AMCA 301 or AHRI 260 (IP). Air-handling unit fan sound ratings shall comply with AMCA 301 or AHRI 260 (IP).
- E. UL Compliance:
  1. Packaged fixed plate energy recovery units shall comply with requirements in UL 1812; or UL 1815.
  2. Electric Coils: Comply with UL 1995.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine casing insulation materials and filter media before packaged, indoor, fixed-plate, energy-recovery unit installation. Replace with new insulation materials and filter media that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Install packaged, indoor, fixed-plate, energy-recovery units, so supply and exhaust airstreams flow in opposite directions.
  1. Install access doors in both supply and exhaust ducts, both upstream and downstream, for access to interior components.
  2. Install removable panels or access doors between supply and exhaust ducts on building side for bypass during startup.
  3. Access doors and panels are specified in Section 233300 "Air Duct Accessories."

- B. Equipment Mounting:
  - 1. Install packaged, indoor, fixed-plate, energy-recovery units on welded angle frame.
  - 2. Comply with requirements for vibration-isolation devices specified in Section 230549 "Vibration Controls for HVAC."
- C. Install units with clearances for service and maintenance.
- D. Provide complete sets of filters as necessary to protect equipment during construction, another change of filters at completion, and leave one additional complete set of filters per Maintenance Material Submittals requirements.
- E. Do not operate fan system until filters (temporary or permanent) are in place.

### **3.3 DUCTWORK CONNECTIONS**

- A. Comply with requirements for ductwork according to Section 233113 "Metal Ducts."
- B. Connect duct to units with flexible connections. Comply with requirements in Section 233300 "Air Duct Accessories."
- C. Isolation Dampers: Install isolation dampers according to Section 233300 "Air Duct Accessories."

### **3.4 ELECTRICAL CONNECTIONS**

- A. Install electrical devices furnished with units but not factory mounted.
- B. Connect wiring according to Section 260519 "Conductors and Cables."
- C. Ground equipment according to Section 260526 "Grounding and Bonding."
- D. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
- E. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
  - 1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Electrical Identification."
  - 2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

### **3.5 CONTROL CONNECTIONS**

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring according to Section 260519 "Conductors and Cables."

### **3.6 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
  - 1. Inspect components, assemblies, and equipment installations, including connections, and test in accordance with manufacturer's installation instructions.
- B. Tests and Inspections:
  - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

### **3.7 ADJUSTING**

- A. Adjust moving parts to function smoothly and lubricate as recommended by manufacturer.
- B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

### **3.8 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

### **END OF SECTION**

**SECTION 23 8126  
SPLIT-SYSTEM AIR-CONDITIONERS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
- B. Submit system and unit specific energy efficiencies to verify compliance with design documents. All energy efficiencies scheduled on the drawings are minimum efficiencies.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Provide calculated releasable refrigerant charge in largest independent circuit for each system, including connecting piping.
  - 3. Wiring Diagrams: For power, signal, and control wiring.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Field quality-control reports.
- B. Warranty: Sample of special warranty.

**1.5 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

**1.6 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Filters: Provide sets of filters for each system as necessary during construction, a clean set for TAB, a clean set at final occupancy, and one additional set of filters as Owner stock. If system includes prefilters, include prefilters.

**1.7 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance:
  - 1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
  - 2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Procedures," and Section 7 - "Construction and System Start-up."
- C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.

## 1.8 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Division 03 - Concrete.
- B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

## 1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period:
    - a. For Compressor: Five year(s) from date of Final Acceptance.
    - b. For Parts: One year(s) from date of Final Acceptance.
    - c. For Labor: One year(s) from date of Final Acceptance.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by the following: Trane, Carrier, or JCI/York. Indoor and outdoor sections shall be by the same manufacturer.

### 2.2 INDOOR UNITS (5 TONS OR LESS)

- A. Concealed Evaporator-Fan Components:
  - 1. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
  - 2. Insulation: Faced, glass-fiber duct liner.
  - 3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
  - 4. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
  - 5. Fan Motors:
    - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
    - b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
    - c. Wiring Terminations: Connect motor to chassis wiring with plug connection.
  - 6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
  - 7. Filters: See requirements specified in Section 234100 "Particulate Air Filtration".
  - 8. Condensate Drain Pans:
    - a. Fabricated with a one or two percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends), and to direct water toward drain connection.
      - 1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
      - 2) Depth: A minimum of 2 inches deep.
    - b. Single-wall or double wall insulated galvanized steel sheet.
    - c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
      - 1) Minimum Connection Size: NPS 1.
    - d. Pan-Top Surface Coating: Asphaltic waterproofing compound.

### 2.3 INDOOR UNITS (6 TONS OR MORE)

- A. Concealed Evaporator-Fan Components:

1. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
2. Insulation: Faced, glass-fiber duct liner.
3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
4. Water Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch; leak tested to 300 psig underwater; with a two-position control valve.
5. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.
6. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
7. Fan Motors:
  - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
  - b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
  - c. Three-phase, permanently lubricated, ball-bearing motors with built-in thermal-overload protection.
  - d. Wiring Terminations: Connect motor to chassis wiring with plug connection.
8. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
9. Filters: See requirements specified in Section 234100 "Particulate Air Filtration".
10. Condensate Drain Pans:
  - a. Fabricated with positive slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
    - 1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
    - 2) Depth: A minimum of 2 inches deep.
  - b. Double-wall, galvanized-steel sheet with space between walls filled with foam insulation and moisture-tight seal.
  - c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
    - 1) Minimum Connection Size: NPS 2.
  - d. Pan-Top Surface Coating: Asphaltic waterproofing compound.
  - e. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

## 2.4 OUTDOOR UNITS (5 TONS OR LESS)

- A. Air-Cooled, Compressor-Condenser Components:
  1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
  2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
    - a. Compressor Type: Scroll.
    - b. Manual-reset high-pressure switch and automatic-reset low-pressure switch.
    - c. Refrigerant: R-410A or A2L type.
    - d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.
  3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.

4. Fan: Aluminum-propeller type, directly connected to motor.
5. Motor: Permanently lubricated, with integral thermal-overload protection.
6. Low Ambient Kit: Permits operation down to 21 deg F.
7. Mounting Base: Polyethylene.

## **2.5 OUTDOOR UNITS (6 TONS OR MORE)**

- A. Air-Cooled, Compressor-Condenser Components:
  1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
  2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
    - a. Compressor Type: Scroll.
    - b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
    - c. Refrigerant: R-410A or A2L type.
    - d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.
  3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
  4. Fan: Aluminum-propeller type, directly connected to motor.
  5. Motor: Permanently lubricated, with integral thermal-overload protection.
  6. Low Ambient Kit: Permits operation down to 45 deg F.
  7. Mounting Base: Polyethylene.

## **2.6 SYSTEMS USING A2L REFRIGERANTS**

- A. Systems using A2L refrigerant shall be listed to UL Standard 60335-2-40, current edition.
- B. Per EPA SNAP 23, systems using A2L refrigerant shall have permanently affixed markings and labeling to indicate refrigerant installed in the system and Notice of leak detection system installed, and shall have service ports, pipes, hoses and other devices through which refrigerant flows to be marked in red.
- C. Systems using A2L with refrigerant charge > 4.0 lbs in its largest independent circuit shall have integral factory installed refrigerant leak detection system mounted in the air handling unit section downstream of the evaporator coil with internal controls to automatically upon refrigerant detected, unit commands compressors and electric heat (if present) off, and commands air handling unit's fan to maximum airflow for air circulation. Once refrigerant has not been detected for a minimum of 5 minutes, unit shall return to normal operation.
- D. For systems using A2L refrigerant, if releasable refrigerant charge in the system exceeds the levels allowed in ANSI/ASHRAE Standard 15 – 2022 or newer for the effective dispersal volume, provide safety isolation valves in both refrigerant lines as release mitigation controls. Valves shall automatically close upon signal from the unit integral refrigerant leak detector. Valve locations shall be as such for releasable refrigerant charge to be less than the levels allowed in ANSI/ASHRAE Standard 15 – 2022 or newer for the effective dispersal volume.

## **2.7 ACCESSORIES**

- A. Control equipment and sequence of operation are specified in Section 230900 "Instrumentation & Control for HVAC" and on the drawings.
- B. Automatic-reset timer to prevent rapid cycling of compressor.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install units level and plumb.
- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

- C. Equipment Mounting:
  - 1. Install ground-mounted, compressor-condenser components on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Division 03 - Concrete.
  - 2. Install ground-mounted, compressor-condenser components on a stainless-steel stand as described on the drawings.
  - 3. Comply with requirements for vibration isolation devices specified in Section 230549 "Vibration Controls for HVAC."

### **3.2 CONNECTIONS**

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.
- C. Duct Connections: Duct installation requirements are specified in Section 233113 "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Section 233300 "Air Duct Accessories."

### **3.3 INSTALLATION OF FILTERS**

- A. Install filters in position to prevent passage of unfiltered air.
- B. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.
- C. Coordinate filter installations with duct and air-handling-unit installations.
- D. Provide complete sets of filters as necessary to protect equipment during construction, another change of filters at completion, and leave one additional complete set of filters per Maintenance Material Submittals requirements.

### **3.4 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

### **3.5 STARTUP SERVICE**

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.

### **3.6 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

### **END OF SECTION**

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**SECTION 23 8127**  
**DUCTLESS-SPLIT-SYSTEM AIR-CONDITIONERS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
- B. Submit system and unit specific energy efficiencies to verify compliance with design documents. All energy efficiencies scheduled on the drawings are minimum efficiencies.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Provide calculated releasable refrigerant charge in largest independent circuit for each system, including connecting piping.
  - 3. Wiring Diagrams: For power, signal, and control wiring.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Field quality-control reports.
- B. Warranty: Sample of special warranty.

**1.5 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

**1.6 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Filters: Provide sets of filters for each system as necessary during construction, a clean set for TAB, a clean set at final occupancy, and one additional set of filters as Owner stock. If system includes prefilters, include prefilters.

**1.7 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance:
  - 1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
  - 2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Procedures," and Section 7 - "Construction and System Start-up."
- C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.

## 1.8 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."
- B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

## 1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period:
    - a. For Compressor: Five year(s) from date of Final Acceptance.
    - b. For Parts: One year(s) from date of Final Acceptance.
    - c. For Labor: One year(s) from date of Final Acceptance.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by the following: Mitsubishi, Daikin, or LG.

### 2.2 INDOOR UNITS (5 TONS OR LESS)

- A. Ductless Wall-or Ceiling Mounted, Evaporator-Fan Components:
  - 1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and condensate drain pans with drain connection.
  - 2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
  - 3. Fan: Direct drive, centrifugal.
  - 4. Fan Motors:
    - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
    - b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
    - c. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
    - d. Mount disconnect switches adjacent to unit.
  - 5. Air Filtration: Permanent, washable.

### 2.3 OUTDOOR UNITS (5 TONS OR LESS)

- A. Air-Cooled, Compressor-Condenser Components:
  - 1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
  - 2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
    - a. Compressor Type: Scroll.
    - b. Compressor Type: Inverter driven scroll.
    - c. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
    - d. Refrigerant: R-410A or A2L type.
    - e. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.
  - 3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.

4. Fan: Aluminum-propeller type, directly connected to motor.
5. Motor: Permanently lubricated, with integral thermal-overload protection.
6. Low Ambient Kit: Permits operation down to 45 deg F.
7. Low Ambient Kit: Permits operation down to 0 deg F.
8. Mounting Base: Polyethylene.
9. Corrosion-Resistant Finish: Coating with documented salt spray test performance of 1000 hours according to ASTM B 117 surface scratch test (SST) procedure.

## 2.4 SYSTEMS USING A2L REFRIGERANTS

- A. Systems using A2L refrigerant shall be listed to UL Standard 60335-2-40, current edition.
- B. Per EPA SNAP 23, systems using A2L refrigerant shall have permanently affixed markings and labeling to indicate refrigerant installed in the system and Notice of leak detection system installed, and shall have service ports, pipes, hoses and other devices through which refrigerant flows to be marked in red.
- C. Systems using A2L with refrigerant charge > 4.0 lbs in its largest independent circuit shall have integral factory installed refrigerant leak detection system mounted in the air handling unit section downstream of the evaporator coil with internal controls to automatically upon refrigerant detected, unit commands compressors and electric heat (if present) off, and commands air handling unit's fan to maximum airflow for air circulation. Once refrigerant has not been detected for a minimum of 5 minutes, unit shall return to normal operation.
- D. For systems using A2L refrigerant, if releasable refrigerant charge in the system exceeds the levels allowed in ANSI/ASHRAE Standard 15 – 2022 or newer for the effective dispersal volume, provide safety isolation valves in both refrigerant lines as release mitigation controls. Valves shall automatically close upon signal from the unit integral refrigerant leak detector. Valve locations shall be as such for releasable refrigerant charge to be less than the levels allowed in ANSI/ASHRAE Standard 15 – 2022 or newer for the effective dispersal volume.

## 2.5 ACCESSORIES

- A. Control equipment and sequence of operation are specified in Section 230923 "Direct Digital Control System" and on the drawings.
- B. Thermostat: Low voltage with subbase to control compressor and evaporator fan.
- C. Thermostat: Hardwired to control compressor and evaporator fan, with the following features:
  1. 24-hour time control of system stop and start.
  2. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
  3. Fan-speed selection including auto setting.
- D. Automatic-reset timer to prevent rapid cycling of compressor.
- E. Monitoring:
  1. Monitor constant and variable motor loads.
  2. Monitor variable-frequency-drive operation.
  3. Monitor economizer cycle.
  4. Monitor cooling load.
  5. Monitor air distribution static pressure and ventilation air volumes.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install units level and plumb.
- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
- C. Equipment Mounting:

1. Install ground-mounted, compressor-condenser components on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
  2. Install ground-mounted, compressor-condenser components on a stainless-steel stand as described on the drawings.
  3. Comply with requirements for vibration isolation devices specified in Section 230549 "Vibration Controls for HVAC."
- D. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

### **3.2 CONNECTIONS**

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

### **3.3 INSTALLATION OF FILTERS**

- A. Install filters in position to prevent passage of unfiltered air.
- B. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.
- C. Coordinate filter installations with duct and air-handling-unit installations.
- D. Provide complete sets of filters as necessary to protect equipment during construction, another change of filters at completion, and leave one additional complete set of filters per Maintenance Material Submittals requirements.

### **3.4 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

### **3.5 STARTUP SERVICE**

- A. Engage a factory-authorized service representative to perform startup service.
1. Complete installation and startup checks according to manufacturer's written instructions.

### **3.6 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

### **END OF SECTION**

**SECTION 23 8239  
WALL UNIT HEATERS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes wall and ceiling heaters with electric-resistance heating coils.

**1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, and details.
  - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Include details of anchorages and attachments to structure and to supported equipment.
  - 4. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
  - 5. Wiring Diagrams: Power, signal, and control wiring.

**1.3 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For wall and ceiling unit heaters to include in emergency, operation, and maintenance manuals.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Subject to compliance with requirements, provide products by the following: Markel, Q-Mark, or Chromolox complete with UL Label.

**2.2 DESCRIPTION**

- A. Heater shall be self-contained baseboard type factory assembled heating unit and shall consist of extruded aluminum frame and casing with 18 gauge inlet and outlet grilles, wall box, electric heating elements, fan, motor, controls and shall comply with UL2021.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Units shall have all wattage, voltage, phase, BTU/hr output and mounting as shown on the drawings or as specified.

**2.3 CABINET**

- A. Front Panel: Extruded-aluminum bar grille with removable panels fastened with tamperproof fasteners.
- B. Finish: Baked enamel over baked-on primer with manufacturer's standard color selected by Architect, applied to factory-assembled and -tested wall and ceiling heaters before shipping.
- C. Surface-Mounted Cabinet Enclosure: Steel with finish to match cabinet.

**2.4 COIL**

- A. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware, and limit controls for high-temperature protection.

**2.5 CONTROLS**

- A. Controls: Built in tamper proof unit-mounted thermostat.

- B. Electrical Connection: Factory wire motors, terminals for control circuits as necessary for a single source of power connection and built in disconnect switch.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Examine areas to receive wall and ceiling heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical connections to verify actual locations before unit-heater installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.2 INSTALLATION**

- A. Install wall and ceiling heaters to comply with NFPA 90A.
- B. Install wall and ceiling heaters level and plumb.
- C. Ground equipment according to Section 260526 "Grounding and Bonding."
- D. Connect wiring according to Section 260519 "Conductors and Cables."

**END OF SECTION**

**SECTION 26 0000  
ELECTRICAL, BASICS**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

**1.2 GENERAL**

- A. Applicable requirements of any Instructions to Bidders, General Conditions of the Contract, and/or Supplemental Conditions shall be a part of the Electrical Specifications. The electrical contractor shall examine all contract documents before submitting a proposal.
- B. The electrical work shall be performed by an electrical contractor, suitably licensed for the scope of work of this specific project.
- C. The electrical contractor shall assume total responsibility for any portion of the work provided by his subcontractors.

**1.3 CODES AND STANDARDS**

- A. Building Codes:
  - 1. National Fire Protection Association No. 70, National Electrical Code (NEC)
  - 2. National Fire Protection Association No. 72, National Fire Alarm and Signaling Code
  - 3. North Carolina State Building Code, Latest Edition and Revisions (NCSBC)
  - 4. North Carolina State Fire Code, Latest Edition and Revisions
  - 5. National Electrical Safety Code (NESC)
  - 6. National Bureau of Standards (NBS)
  - 7. Local Codes where applicable
- B. Industry Standards:
  - 1. Underwriter's Laboratories, Inc. Standards and approved listings (UL)
  - 2. Electrical Testing Laboratories Standards (ETL)
  - 3. National Electrical Manufacturers Association Standards (NEMA)
  - 4. Insulated Power Cable Engineers Association Standards (IPCEA)
  - 5. American National Standards Institute (ANSI)
  - 6. American Society for Testing Materials Standards (ASTM)
  - 7. Canadian Standards Association (CSA)

**1.4 QUALITY ASSURANCE**

- A. Electrical materials, equipment, devices, fixtures, etc. shall be listed and labeled by a third-party agency that is accredited by the NCBCC (North Carolina Building Code Council) to label electrical & mechanical equipment. Listing and labeling shall comply with NC Department of Insurance requirements as detailed in NC General Statutes 66-23 through 66-25. This paragraph applies to all electrical specification sections under specification divisions 26, 27, and 28.

**1.5 SCOPE OF WORK**

- A. It is the intent and meaning of the drawings and specifications to call for finished work that has been tested and is ready for operation. The electrical contractor shall take this into consideration and include in his proposal allowance for contingencies that will allow him to provide minor pieces of materials and labor not specifically indicated but required for the job to operate properly. This paragraph is intended to insure that a complete job will be provided without requests for minor extras.
- B. It shall be understood that where the words "furnish," "provide," and/or "install" are used, it is intended that this CONTRACTOR shall purchase and install completely all material necessary and required for this particular item, system, equipment, etc.

## **1.6 ELECTRICAL SERVICE**

- A. The electrical contractor shall be totally responsible for coordination with the Utility Company and assistance to the OWNER to obtain a permanent electrical service for the structure. He shall act as coordinator between the Utility Company and the OWNER and shall supply the Utility Company with equipment characteristics, load data, etc. Any installation, connection, underground service or special fees charged by the Utility Company for the new service shall be paid by the OWNER. Construction and testing power shall be paid for as described in the General Conditions of the project manual.
- B. Electrical service to the structure shall be 277/480 volts, 3 phase, 4 wire.
- C. The electrical contractor shall coordinate the electrical service, metering and metering equipment with the local utility company for arrangements, locations, connections, etc.
- D. Utility transformer pads shall be installed by the electrical contractor. Coordinate equipment pad requirements with the local utility company.
- E. Current transformer cabinets and self-contained meter cabinets shall be installed by the electrical contractor, unless directed otherwise by the Utility Company. Coordinate metering requirements with the Utility Company before rough-in of service raceways.
- F. The electrical service entrance raceways shall be installed by the electrical contractor and sized as shown on the contract drawings, or as required by the Utility Company. Service entrance conductors will be provided and installed by the Utility Company to the line side of the metering equipment. Service entrance conductors from the metering equipment to the service equipment shall be provided by the electrical contractor. Load side connections shall be made by the electrical contractor.

## **1.7 RECORD DRAWINGS**

- A. A set of drawings covering the electrical contract will be provided to the electrical contractor to mark in color all changes, modifications, or revisions effected during construction. These field mark-up drawings are to be turned over to the electrical designer.
- B. The electrical contractor shall provide final installed photographs of switchboards and panelboards. Photographs shall clearly show equipment designations, manufacturer nameplates, breaker positions, breaker ratings, and directory descriptions.

## **1.8 APPROVAL OF MATERIALS**

- A. See project manual contract documents for pre-proposal substitution requirements.
- B. Construction phase: The CONTRACTOR shall submit his proposal on the specified materials and equipment, or their equivalent, provided the words "or equal" or "or approved equal" follow the named manufacturers. If the above phrases do not appear, the specified manufacturers shall be furnished without substitution. Equivalent shall be interpreted to mean an item of material or equipment, similar to that named and which is suitable for the same use and capable of performing the same functions as that named, with the Design Team being the judge of equality.
- C. Where no specific material or equipment type is mentioned, any first-class product of a reputable manufacturer may be used provided it conforms to the requirements of the specifications.

## **1.9 SHOP DRAWINGS AND SUBMITTAL DATA PROCEDURES**

- A. The CONTRACTOR shall submit PDF files of shop drawings, certified prints, literature, and product data sheets to the Design Team for all major items of equipment and materials for review and approval. It is preferred that all electrical submittals for the project shall be submitted at one and the same time.
- B. Product data sheets with multiple components, part numbers, etc. shall be clearly marked or highlighted to identify what specific product/model/part number/component is proposed for this project. All instances of the proposed part number components in the product data shall be marked or highlighted throughout product data sheets submitted.



- C. The CONTRACTOR shall analyze all shop drawings and submittal data and certify that they meet requirements of Contract Drawings and Specifications, prior to delivery to the Design Team. CONTRACTOR Certification shall be in the form of suitable approval stamp placed on each shop drawing/submittal submitted.
  - 1. If the shop drawings or submittal data deviate from the Contract Documents, the CONTRACTOR shall advise the Design Team of deviations in writing, accompanying the shop drawings and submittal data, including the reason for deviations.
- D. If the Design Team deems submittal data is either incomplete or incorrect, a resubmittal will be required. Where a resubmittal is not necessary but confirmation of receipt of review comments is requested, confirmation shall be submitted in writing.
- E. At least one set of all final submittal data, shop drawings, certified prints, etc., shall be maintained at the job site and available to representatives of the Design Team.
- F. Approval by the Design Team of shop drawings and submittal data is for general conformance with the contract documents and design concept.
  - 1. Such approval does not relieve the CONTRACTOR of responsibility for compliance with the project drawings and specifications.
  - 2. Such approval for any materials, apparatus, devices, and layouts shall not relieve the CONTRACTOR from the responsibility of furnishing same of proper dimensions, size, quantity, quality and all performance characteristics to efficiently complete the requirements and intent of the contract documents.
  - 3. Such approval shall not relieve the CONTRACTOR from responsibility for errors of any sort on the shop drawings.
- G. Physical sizes of equipment used in the design layout are those of reputable equipment manufacturers. The CONTRACTOR is responsible for providing equipment that will fit the space available. If the CONTRACTOR elects to use equipment that results in conflicts with space clearance or codes, it shall be the responsibility of the CONTRACTOR to correct at his expense. The CONTRACTOR shall be responsible for providing code clearances. Where equipment is designated for existing space, the CONTRACTOR shall make necessary field measurements to ascertain space requirements, including those for connections; and shall furnish and install such sizes and shapes of equipment that the final installation shall suit the intent and meaning of the drawings and specifications.
- H. Catalog Data for OWNER
  - 1. The CONTRACTOR shall provide compilations of catalog data, bound in suitable loose-leaf binders, for each manufactured item of equipment used in the electrical work. These shall be presented to the Design Team for transmittal to the OWNER before the final inspection is made. Data shall include printed installation, operation, and maintenance instructions for each item, indexed by product with heavy sheet dividers and tabs. All warranties shall be included with each item. Each manufacturer's name, address, and telephone number shall be clearly indicated. Generally, shop drawings and submittal data alone are not adequate for catalog data.
- I. Record Documents for OWNER
  - 1. Conductor and cable megger test results.
  - 2. Field mark-up as-built drawings.
  - 3. Grounding electrode system test results.
  - 4. Transformer tap settings and output voltages.
  - 5. Circuit breaker trip settings.
  - 6. Emergency lighting test results.
  - 7. Communications backbone cable:
    - a. Test results.
    - b. Cable schedule.
    - c. Cable administration drawings.
  - 8. Communications horizontal cable:
    - a. Test results.

- b. Cable schedule.
  - c. Cable administration drawings.
- 9. Fire alarm system:
  - a. NFPA 72 Fire Alarm System Record of Completion.
  - b. System Status and Programming Report.
  - c. System operational matrix.
  - d. Digital copy of system software on USB flash drive.
- 10. Emergency responder radio coverage system:
  - a. Documentation of system acceptance by the local Fire Marshal / AHJ.
  - b. RF Survey / Shop Drawings: Final installed measurement drawings of each floor of the building which indicate relative RF field strength for each frequency and band of interest.
- 11. Warranty documents.

#### **1.10 DRAWINGS AND SPECIFICATIONS**

- A. The Electrical drawings and specifications are complementary each to the other, and what may be called for by one shall be as binding as if called for by both. The drawings are diagrammatic and indicate generally the location of outlets, devices, equipment wiring, etc and show the general arrangement of raceways, fixtures, and equipment. Drawings shall be followed as closely as actual building construction and the work of other trades will permit; however, all work shall suit the finished surroundings and/or trim.
- B. Any omission from either the drawings or the specifications are unintentional, and it shall be the responsibility of the CONTRACTOR to call to the attention of the Design Team any pertinent omissions before submitting a proposal. Complete and working systems are required, whether every small item of material is shown and specified or not.
- C. The electrical work shall conform to the requirements shown on all of the drawings. General and Structural drawings shall take precedence over Electrical Drawings. Because of small scale of the electrical drawings, it is not practical to indicate offsets, fittings and accessories that may be required. The CONTRACTOR shall investigate the structural and finish conditions affecting the work and shall arrange his work accordingly, providing such fittings and accessories as may be required to meet such conditions, without additional cost to the OWNER and as directed by the Design Team.
- D. Load circuits shall be installed as indicated on the drawings. Circuit number revisions will not be accepted unless approved in writing by the Engineer.

#### **1.11 COORDINATION OF WORK**

- A. It is understood and agreed that by submitting a proposal, the CONTRACTOR has, by careful examination, satisfied himself as to the nature and location of the work, the conformation of the ground, the character, quality and quantity of the materials to be encountered, the general and local conditions and all other matters which can and may affect the work under this contract. The CONTRACTOR shall be held responsible for visiting the site and thoroughly familiarizing himself with the existing conditions and also any contractual requirements as may be set forth in other divisions of the specifications and in other contract documents. No extras will be considered because of additional work necessitated by obvious job conditions that are not indicated on the drawings.
- B. The CONTRACTOR shall compare the electrical drawings and specifications with the drawings and specifications for other trades and shall report any discrepancies between them to the Design Team. If needed, request from the Design Team written instructions for changes necessary in the electrical work. The electrical work shall be installed in cooperation with other trades installing interrelated work. Before installation, the CONTRACTOR shall make proper provisions to avoid interferences in a manner approved by the Design Team. All changes required in the work of the CONTRACTOR caused by his neglect to do so shall be made by him at his expense.

- C. Location of electrical raceways, switches, panels, equipment, fixtures, etc., shall be adjusted to accommodate the work to interferences anticipated and encountered. The CONTRACTOR shall determine the exact route and location of each electrical raceway prior to make up and assembly.
- D. Right-of-Way: Lines which pitch shall have the right-of-way over those which do not pitch. For example; steam, condensate and plumbing drains shall normally have right of way. Lines whose elevations cannot be changed shall have the right of way over lines whose elevations can be changed.
- E. Offsets and changes in direction of electrical raceways shall be made as required to maintain proper headroom and to clear pitched lines whether or not indicated on the drawings. The CONTRACTOR shall furnish and install elbows, pull boxes, etc., as required to affect these offsets, transitions, and changes in directions. Conflicts between electrical raceways, fixtures, etc., and ductwork which cannot be resolved otherwise, will be resolved by the Design Team.
- F. The CONTRACTOR shall install all electrical work to permit removal (without damage to other parts) of any equipment requiring periodic replacement or maintenance. The CONTRACTOR shall arrange electrical raceways and equipment to permit ready access to valves, cocks, traps, starters, motors, control components, etc., and to clear the opening of swinging and overhead doors and of access panels.
- G. Electrical Work Coordinated with Other Disciplines:
  - 1. Heating, Ventilating and Air Conditioning Equipment:
    - a. The electrical contractor shall provide a source of power for all mechanical equipment. "Source" shall include conductors, raceways, circuit breakers, junction boxes, panelboards and/or wiring troughs as required by conditions and codes and/or as shown on the contract drawings.
    - b. In general, individual disconnecting means for each mechanical equipment unit will be furnished and installed by the Mechanical Contractor. Line side connections shall be made by the electrical contractor. All load side wiring will be accomplished by the Mechanical Contractor.
    - c. If a rooftop unit is not provided with an integral disconnect switch, the individual disconnecting means for the unit will be furnished and installed by the electrical contractor.
    - d. See Mechanical Specifications for further explanation of CONTRACTOR responsibility.
  - 2. Plumbing Equipment:
    - a. Hot Water Circulating Pump: The electrical contractor shall provide power supply to a junction box adjacent to each hot water circulating pump and shall consult the Plumbing Contractor to determine the exact power supply location before roughing in. Circuitry and equipment between the junction box and the pump, including final connections, shall be provided by the contractor providing the equipment.
    - b. Water Heaters: The electrical contractor shall provide a junction box adjacent to the water heater as a source of power. Circuitry and equipment between the junction box and the water heater, including final connections, shall be provided by the contractor providing the equipment.
    - c. Electric Water Coolers: As indicated on the drawings, the electrical contractor shall provide either a grounding type 120V, GFCI receptacle for power supply at each electric water cooler, or the branch breaker supplying a grounding type 120V receptacle shall be GFCI type. The electrical contractor shall consult the Plumbing Contractor to determine the exact outlet location required before roughing in. All outlets and cords shall be concealed within the cabinet.
  - 3. Civil / Site Equipment:
    - a. The electrical contractor shall provide a source of power for all civil / site equipment. "Source" shall include feeder and branch circuit breakers, raceways, conductors, receptacles, junction boxes, and/or wiring troughs as required by

conditions and codes and/or as shown on the contract drawings. See Civil / Control Specifications for controls, controller, control panel responsibility.

- b. Final power connections to equipment shall be provided by the contractor providing the equipment.

H. Equipment and Materials (General):

1. Materials shall be new and shall bear the manufacturer's name, trade name, and listing label in every case where a standard has been established for the particular material. The equipment to be furnished under this specification shall be essentially the standard product of manufacturers regularly engaged in the production of the required type of equipment and shall be the manufacturer's latest approved design.
2. Electrical motors shall meet the minimum efficiency requirements identified in the Code of Federal Regulations 10 CFR Part 431.
3. Delivery and Storage:
  - a. Store products to allow for inspection and measurement of quantity or counting of units.
  - b. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
    - 1) Electrical equipment shall be delivered to the site and stored in original containers. Store protected from the elements, but readily accessible for inspection by the Design Team until installed. Equipment shall be tightly covered and protected against dirt, water and chemical or mechanical injury and theft. Corrosion inhibitors shall be installed in all panelboards, switches, starters and control panels immediately upon receipt. Install one inhibitor for every 8 cubic feet of enclosure volume. Replace inhibitors every 90 days and at final inspection in the Design Team's presence. Rusty and/or corroded materials and equipment will be replaced at the direction of the Design Team.
    - 2) Rusty and/or corroded materials and equipment will be replaced at the direction of the Design Team.
  - c. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
  - d. Protect stored products from damage.
4. Equipment and materials of the same general type shall be of the same make throughout the work to provide uniform appearance, operation and maintenance.
5. At the completion of work; fixtures, equipment, and materials shall be cleaned and polished thoroughly and turned over to the OWNER in a condition satisfactory to the Design Team. Damage or defects, developing before acceptance of the work shall be corrected at the CONTRACTOR's expense.
6. Manufacturer's directions shall be followed completely in the delivery, storage, protection, and installation of all equipment and materials. The CONTRACTOR shall promptly notify the Design Team, in writing, of any conflicts between requirements of the Contract Documents and the manufacturer's directions and shall obtain the Design Team's written instructions before proceeding with the work. Should the CONTRACTOR perform any work that does not comply with the manufacturer's instructions, recommendations, or requirements; it shall be corrected at his expense as directed by the Design Team.

I. Sleeves, Inserts, Openings, Etc.:

1. Anchor bolts, sleeves, inserts, supports, etc., that may be required for electrical work shall be furnished, located, and installed by the electrical contractor. Where working under a subcontract for a General Contractor, the electrical contractor shall give sufficient information (marked and located) to the General Contractor in time for proper placement in the construction schedule. Should the electrical contractor delay or fail to provide sufficient information in time, the electrical contractor shall cut and patch construction as

necessary and required to install electrical work, with finishes completed to the satisfaction of the the Design Team.

- J. Cutting and Patching:
  - 1. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. The electrical contractor shall be responsible for cutting and patching as required for the proper installation of electrical work for this project. Cutting shall be kept to a minimum. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Finishes shall be restored to the satisfaction of the the Design Team.
- K. Locations and Measurements:
  - 1. Outlets, equipment, fixtures, etc. are shown and located on the drawings as intended based on the Design Team's understood project scope. All measurements for installation shall be verified on the project and coordinated with the drawings of other disciplines. In all cases, work shall suit the surrounding trim and/or decoration and construction. The locations of outlets for appliances shall be installed so that when connected they permit the proper installation of appliances. Slight relocations of outlets, devices, and equipment shall be made by the electrical contractor as required or as directed by the Design Team at no additional cost to the OWNER.
- L. Workmanship:
  - 1. Work shall be executed as required by the drawings and specifications, shall be done in a workmanlike manner by skilled mechanics, and shall present a neat, trim, and mechanical appearance when completed. All work shall be performed as required by the progress of the job.
- M. Final Inspections and Equipment Demonstrations:
  - 1. The CONTRACTOR shall acquire permits for construction & coordinate all required inspections with the office of the local electrical inspector and/or local authority having jurisdiction, if required. The CONTRACTOR shall provide the Owner two (2) copies of Electrical Inspectors' written reports.
  - 2. The CONTRACTOR shall furnish ladders, required tools, and personnel to open equipment, fixtures, boxes, panels, etc. to enable the Design Team representatives to observe any parts of the installation they may request.
  - 3. The CONTRACTOR shall furnish meters for observation of readings as directed by the Design Team representative. Meters to be furnished include: clamp-on type ammeter, voltmeter, insulation resistance tester (i.e., often called a megger), and clamp-on type ground resistance tester.
- N. Operating Instructions:
  - 1. At the completion of the entire installation, the CONTRACTOR shall arrange to operate each component of systems and then systems as a whole. When all the requirements of the plans and specifications have been met, the CONTRACTOR shall then arrange to instruct the OWNER's operating and maintenance personnel in the correct and proper procedures for the operation and maintenance of the systems

**END OF SECTION**

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**SECTION 26 0500  
BASIC ELECTRICAL MATERIALS AND METHODS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Supporting devices for electrical components.
  - 2. Cutting and patching for electrical construction.
  - 3. Touchup painting.
  - 4. Firestopping
  - 5. Concrete equipment bases.
  - 6. Electricity-metering components.

**1.3 SUBMITTALS**

- A. Product Data:
  - 1. Support channels and hardware.
  - 2. For materials to firestop cable and raceway penetrations of fire-rated floor and wall assemblies.
  - 3. For electricity-metering equipment.
- B. Shop Drawings: UL details for firestopping cable and raceway penetrations of fire-rated floor and wall assemblies.

**1.4 QUALITY ASSURANCE**

- A. Comply with NFPA 70.

**PART 2 - PRODUCTS**

**2.1 SUPPORTING DEVICES**

- A. Metal Items for Use Indoors: Plain Steel.
- B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.
- C. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32 inch diameter holes at a maximum of 8 inch on center in at least one surface.
- D. Aluminum Slotted Support Systems: Preformed aluminum channels and angles with minimum 13/32 inch diameter holes at a maximum of 8 inch on center in at least one surface.
- E. Slotted Support Systems Fittings and Accessories: Products of the same manufacturer as channels.
- F. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.
- G. Expansion Anchors:
  - 1. Inside: Carbon-steel wedge or sleeve type.
  - 2. Outside: Hot-dip galvanized steel wedge or sleeve type.
- H. Toggle Bolts:
  - 1. Inside: All steel springhead type.
  - 2. Outside: Hot-dip galvanized steel springhead type.

**2.2 TOUCHUP PAINT**

- A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
- B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

### **2.3 FIRESTOPPING**

- A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

### **2.4 CONCRETE BASES**

- A. Concrete: Unless detailed otherwise; 3000-psi, 28-day compressive strength with welded wire fabric reinforcement.

### **2.5 EQUIPMENT FOR UTILITY COMPANY'S ELECTRICITY METERING**

- A. Current-Transformer Cabinets: Comply with requirements of electrical power utility company.
- B. Meter Sockets: Comply with requirements of electrical power utility company.

## **PART 3 - EXECUTION**

### **3.1 COORDINATION**

- A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange during progress of construction to facilitate the electrical installations that follow.
  - 1. Set inserts, sleeves, raceways, boxes, etc. in poured-in-place concrete, masonry work, and other structural components as they are constructed.
- B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.
- C. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces.
- D. Coordinate electrical service connections to components furnished by utility companies.
  - 1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
  - 2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.

### **3.2 ELECTRICAL EQUIPMENT INSTALLATION**

- A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.
- B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

### **3.3 ELECTRICAL SUPPORTING DEVICE APPLICATION**

- A. Selection of Supports: Comply with manufacturer's written instructions.
- B. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb (90-kg) design load.

### **3.4 SUPPORT INSTALLATION**

- A. Install support devices to securely and permanently fasten and support electrical components.
- B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.
- C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
- D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.



- E. Support individual horizontal raceways with separate pipe hangers or clamps.
- F. Install 1/4-inch- diameter or larger threaded hanger rods, unless otherwise detailed.
- G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of hangers for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.
- H. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches from the box.
- I. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.
- J. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
- K. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:
  - 1. Wood: Fasten with wood screws or screw-type nails.
  - 2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
  - 3. New Concrete: Concrete inserts with machine screws and bolts.
  - 4. Existing Concrete: Expansion bolts.
  - 5. Steel: Spring-tension clamps on steel.
  - 6. Light Steel: Sheet-metal screws.
  - 7. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

### **3.5 FIRESTOPPING**

- A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly.

### **3.6 CONCRETE BASES**

- A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated.

### **3.7 UTILITY COMPANY ELECTRICITY-METERING EQUIPMENT**

- A. Install equipment according to utility company's written requirements. Provide grounding and empty conduits as required by utility company.

### **3.8 FIELD QUALITY CONTROL**

- A. Inspect installed components for damage and faulty work.

### **3.9 REFINISHING AND TOUCHUP PAINTING**

- A. Refinish and touch up paint.
  - 1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
  - 2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.

3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

**3.10 CLEANING AND PROTECTION**

- A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
- B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Final Acceptance.

**END OF SECTION**

**SECTION 26 0519  
CONDUCTORS AND CABLES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

**1.3 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Field Quality-Control Test Reports: From Contractor.

**PART 2 - PRODUCTS**

**2.1 POWER CONDUCTORS AND CABLES**

- A. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.
- B. Conductor Material:
  - 1. Copper complying with NEMA WC70 / ICEA S-95-658 solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.
  - 2. Power and lighting circuitry: Minimum conductor size shall be #12, and maximum conductor size shall be #500 kcmil.
- C. Conductor Insulation Types: Type THHN/THWN-2 complying with NEMA WC70 / ICEA S-95-658.

**2.2 CONTROL CONDUCTORS AND CABLE**

- A. Discrete control conductors: Copper, stranded, type THHN/THWN-2.

**2.3 CONNECTORS AND SPLICES**

- A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.
  - 1. For conductors #8 & smaller, use wire-nut type twist connectors.
  - 2. For conductors #6 & larger, use pre-insulated solderless connectors with one spare port for future cable connection.

**PART 3 - EXECUTION**

**3.1 CONDUCTOR AND INSULATION APPLICATIONS**

- A. Service Entrance, Feeders, Branch Circuits: Type THHN/THWN-2, single conductors in raceway.
- B. Branch Circuits:
  - 1. Concealed in Ceilings: Type THHN/THWN-2, single conductors in raceway.
  - 2. Concealed in Walls and Partitions: Type THHN/THWN-2, single conductors in raceway.
  - 3. Exposed: Type THHN/THWN-2, single conductors in raceway.
  - 4. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- C. Discrete Control Circuits: Type THHN/THWN-2, in raceway.
- D. Class 1 Control Circuits: Type THHN/THWN-2, in raceway.

**3.2 INSTALLATION**

- A. Use manufacturer-approved pulling compound or lubricant where necessary. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

- B. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables, conductors, or raceway.
- C. Identify and color-code conductors and cables according to Section "Electrical Identification".
- D. Shared neutral conductors shall not be used unless specifically indicated so on homerun circuitry designations on the drawings.

### **3.3 CONNECTIONS**

- A. Connect equipment, outlet, device, and component connections to wiring systems and to ground. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B. Where tightening torque is indicated as a numeric value on equipment or in installation instructions provided by the manufacturer, a calibrated torque tool shall be used to achieve that indicated torque value, unless the equipment manufacturer has provided installation instructions for an alternative method of achieving required torque.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

### **3.4 FIELD QUALITY CONTROL**

- A. Testing: Perform the following field quality-control testing:
  - 1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
  - 2. Inspect for physical damage. test conductors and cable for continuity and shorts.
  - 3. Insulation Resistance (Megger) testing for building wire and cable:
    - a. All current carrying phase conductors and neutrals shall be tested as installed, and before connections are made, for insulation resistance and accidental grounds. This shall be done with a 500-Volt insulation resistance tester. Insulation resistance testers shall not be electronic type. Insulation resistance testers shall be hand crank or power-driven crank type. Minimum readings between conductors and between conductor and the grounded metal raceway shall be: 25 mega-ohms for #6 wire and smaller; 50 mega-ohms for #4 wire or larger.
    - b. The CONTRACTOR shall correct malfunctioning conductors and cables, including replacement if necessary, and retest to demonstrate compliance.
    - c. Certify compliance with test parameters.
  - 4. Control / Signal Transmission Media Tests:
    - a. Test cable segments for faulty connectors, splices, terminations, and the integrity of the cable and its component parts.
    - b. Correct malfunctioning conductors and cables at Project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.
- B. Test Reports: Prepare a written report to record the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
  - 4. Provide tabulated insulation resistance readings for each panel circuit.
- C. Witness Tests:
  - 1. The CONTRACTOR shall furnish an insulation resistance tester and show Design Team representative and/or Owner that the conductors comply with the specified requirements.

### **END OF SECTION**

**SECTION 26 0526  
GROUNDING AND BONDING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

**1.3 SUBMITTALS**

- A. Product Data: For the following:
  - 1. Ground rods.
  - 2. Connection / test / inspection wells.
- B. Field Test Reports: Submit written test reports to include the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

**1.4 QUALITY ASSURANCE**

- A. Comply with UL 467.

**PART 2 - PRODUCTS**

**2.1 GROUNDING CONDUCTORS**

- A. For insulated conductors, comply with Section "Conductors and Cables."
- B. Grounding Electrode Conductors: Stranded cable.
- C. Bare Copper Conductors: Comply with the following:
  - 1. Solid Conductors: ASTM B 3.
  - 2. Assembly of Stranded Conductors: ASTM B 8.
  - 3. Tinned Conductors: ASTM B 33.
- D. Grounding Bus:
  - 1. Bare, annealed copper bars of rectangular cross section .
  - 2. ¼" thick, 4" wide, length as required or minimum length as detailed.
  - 3. Stand-off insulator mounting brackets.

**2.2 CONNECTOR PRODUCTS**

- A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
- B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.
- C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

**2.3 GROUNDING ELECTRODES**

- A. Ground Rods: Sectional type; copper-clad steel, ¾" diameter by 120 inches in length.
- B. Connection / Test / Inspection Wells: Provide handholes as specified below:
  - 1. Cylinder, minimum dimensions of 10" diameter x 10" deep, PVC, with cover.
  - 2. Box, minimum dimensions of 12" x 12" x 12" deep with cover, green PVC or polyethylene.

## **PART 3 - EXECUTION**

### **3.1 APPLICATION**

- A. In raceways, use insulated equipment grounding conductors.
- B. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.
- C. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
  - 1. Use insulated spacers; space 1 inch minimum from wall and support 12 inches above finished floor, unless otherwise indicated.
- D. Underground Grounding Conductors: Use bare, tinned, stranded-copper conductors. Bury a minimum of 24 inches below grade or bury 12 inches above duct bank when installed as part of a duct bank.

### **3.2 EQUIPMENT GROUNDING CONDUCTORS**

- A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
- B. Install equipment grounding conductors in all feeders and circuits.

### **3.3 INSTALLATION**

- A. Ground Rods:
  - 1. For service entrance, install a minimum of two rods spaced at least twenty-two feet from each other and located at least the same distance from other grounding electrodes.
  - 2. Drive ground rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
  - 3. Interconnect ground rods with grounding electrode conductors. Use exothermic welds for connections to ground rods. Make connections without exposing the ground rod steel.
- B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- C. Building Steel: Provide insulated copper grounding conductor, in conduit, from building's main service equipment, or grounding bus, to building steel. Connect grounding conductors to building steel by exothermic weld.
- D. Metal Water Service Pipe: Provide insulated copper grounding conductor, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Connection shall be made within the first five feet of where the water service line enters the building. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting.
- E. Where grounding electrode conductors are installed in metal conduit, bond metal conduit to conductor at each end with a grounding bushing.
- F. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, Paragraph 250.52(A)(3), using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG. If using structure concrete foundation, and it is less than 20 feet long, coil excess conductor within the base of the foundation. Bond conductor to reinforcing steel. Extend grounding conductor below grade and connect to building grounding ring or to a grounding electrode external to concrete.

### **3.4 CONNECTIONS**

- A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
  2. Make connections with clean, bare metal at points of contact.
  3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

### **3.5 FIELD QUALITY CONTROL**

- A. Testing: Perform the following field quality-control testing:
1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
  2. Test completed grounding system at service disconnect enclosure grounding terminal or main ground bar, at ground test wells, and at any other location where a maximum ground-resistance level is specified. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    - a. Perform tests by the fall-of-potential method according to IEEE 81; or
    - b. Perform tests with a clamp-on ground tester.
  3. Maximum grounding electrode system resistance values:
    - a. Equipment Rated 500 kVA and Less: 10 ohms.
    - b. Equipment Rated 500 to 1000 kVA: 5 ohms.
    - c. Equipment Rated More Than 1000 kVA: 3 ohms.
    - d. Substations and Pad-Mounted Switching Equipment: 5 ohms.
    - e. Manhole Grounds: 10 ohms.
  4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and take corrective action to reduce ground resistance to comply with specified values. Demonstrate compliance by retesting.

**END OF SECTION**

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**SECTION 26 0533  
RACEWAYS AND BOXES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Related Sections include the following:
  - 1. Section "Basic Electrical Materials and Methods" for supports, anchors, and identification products.
  - 2. Section "Wiring Devices" for devices installed in boxes.

**1.3 DEFINITIONS**

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. IMC: Intermediate metal conduit.
- D. LFMC: Liquidtight flexible metal conduit.
- E. RNC: Rigid nonmetallic conduit.

**1.4 SUBMITTALS**

- A. Product Data: For raceways, fittings, wireways, floor boxes, hinged-cover enclosures, and cabinets.
- B. Paint Chart: Finish / color selection chart for in-grade hand holes; for selection by Architect.

**1.5 COORDINATION**

- A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

**1.6 FIELD CONDITIONS**

- A. Ground Water: Assume ground-water level is at grade level unless a lower water table is noted on Drawings.

**PART 2 - PRODUCTS**

**2.1 METALLIC CONDUIT**

- A. IMC: Produced to ANSI C80.6; listed to UL 1242.
- B. EMT and Fittings: Produced to ANSI C80.3; listed to UL 797.
  - 1. Fittings: Plated-steel, hexagonal, compression type.
- C. FMC: Listed to UL 1.
- D. LFMC: Listed to UL 360.
- E. Fittings: NEMA FB 1; compatible with conduit and tubing materials.

**2.2 NONMETALLIC CONDUIT AND TUBING**

- A. RNC: Produced to NEMA TC 2; listed to UL 651.
  - 1. Schedule 40 and Schedule 80 PVC.
- B. RNC Fittings: Produced to NEMA TC 3; listed to UL 514B; match to conduit or tubing type and material.

**2.3 METAL WIREWAYS**

- A. Listed to UL 870.

- B. Material and Construction: Sheet metal sized and shaped as indicated.
  - 1. Indoors: NEMA 1.
  - 2. Outdoors: NEMA 3R.
- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Select features as required to complete wiring system and to comply with NFPA 70.
- E. Wireway Covers:
  - 1. Indoors: Hinged type.
  - 2. Outdoors: Flanged-and-gasketed type.
- F. Finish: Manufacturer's standard enamel finish.

## **2.4 BOXES, ENCLOSURES, AND CABINETS**

- A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.
- C. Floor Box, Metallic Recessed Access and Recessed Floor Box Covers:
  - 1. Floor box with provisions for mounting wiring devices below floor surface.
  - 2. Floor box cover shall have provisions for passage of cords to recessed wiring devices mounted within floor box.
  - 3. Recessed configuration shall accommodate device cords plugged in with plugs being completely concealed with the box cover closed.
- D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- E. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- F. Metal Hinged-Cover Enclosures:
  - 1. Interior Locations: NEMA 250, Type 1 with continuous hinged cover, concealed hinge, and flush latch. Finished inside and out with manufacturer's standard enamel.
  - 2. Exterior Locations: NEMA 250, Type 3R galvanized steel with continuous hinged cover and 3-point latch.
  - 3. Removable interior panel.
  - 4. Metal barriers to separate wiring of different systems and voltages.
  - 5. Accessory feet where required or freestanding applications.
- G. Recessed steel TV box:
  - 1. Power and low voltage applications for flat screen TV's.
  - 2. Recessed space to keep plugs, connectors, and cords inside the box.
  - 3. Non-metallic, paintable white trim plate.
  - 4. Design Basis: Arlington #TVBS Series.
- H. HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING
  - 1. General Requirements for Handholes and Boxes:
    - a. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
  - 2. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.
    - a. Manufacturers:
      - 1) Armorcast.
      - 2) Oldcastle Infrastructure.
      - 3) Quazite.
      - 4) Preapproved equal.
    - b. Configuration: Designed for flush burial with open bottom unless otherwise indicated.

- c. Cover:
  - 1) Weatherproof, secured by tamper-resistant locking devices.
  - 2) Structural load rating consistent with enclosure and handhole location. See drawing details for additional requirements.
  - 3) Nonskid finish.
  - 4) Cover legend text as detailed.
- d. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

### **PART 3 - EXECUTION**

#### **3.1 RACEWAY APPLICATION**

- A. Outdoors:
  - 1. Exposed: Rigid metal or IMC.
  - 2. Concealed: Rigid metal or IMC.
  - 3. Underground, Single Run: RNC.
  - 4. Underground, Grouped: RNC.
  - 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  - 6. For grounding electrode conductors: RNC Schedule 80.
  - 7. Boxes and Enclosures: NEMA 250, Type 3R.
- B. Indoors:
  - 1. Exposed, Higher than 10' AFF: EMT.
  - 2. Exposed, Lower than 10' AFF:
    - a. In Electrical Rooms: EMT.
    - b. Elsewhere: Rigid metal or IMC.
  - 3. Concealed:
    - a. Ceilings: EMT.
    - b. Gypboard walls: EMT.
    - c. Masonry walls: RNC.
  - 4. Underground branch circuits: RNC.
  - 5. Underground feeders: RNC. Where turning up out of the slab, a rigid metal elbow and rigid metal conduit stub-up shall be used.
  - 6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations.
  - 7. Damp or Wet Locations: Rigid metal conduit.
  - 8. For grounding electrode conductors: RNC Schedule 80.
  - 9. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
    - a. Damp or Wet Locations: NEMA 250, Type 4.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
  - 1. Intermediate Steel Conduit: Use threaded rigid metal conduit fittings, unless otherwise indicated.
- E. Do not install aluminum conduits embedded in or in contact with earth or concrete. For direct burial or concrete encasement or penetrations, coat conduit with asphaltum or bituminous type coating.
- F. EMT shall not be installed where raceway or fittings would be in direct contact with the earth, underground, in/below concrete, exposed to the elements, exposed to severe physical damage, or exposed to severe corrosive influence.

### 3.2 INSTALLATION

- A. Keep raceways a minimum of 6 inches away from runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- B. Complete raceway installation before starting conductor installation.
- C. Support raceways as specified in Section "Basic Electrical Materials and Methods."
- D. Install temporary closures to prevent foreign matter from entering raceways.
- E. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.
- F. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.
- G. Conceal raceways within finished walls, ceilings, and floors, unless otherwise indicated.
  - 1. Install concealed raceways with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.
- H. Conduits installed on the inside face of exterior building walls shall be spaced off the wall surface a minimum of 1/4" using strut-type channel or "clamp-backs".
- I. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
  - 1. Run parallel or banked raceways together on common supports.
  - 2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- J. Join raceways with fittings designed and approved for that purpose and make joints tight.
- K. Raceway connectors shall be insulated throat type. If uninsulated throat connectors are installed, use insulating bushings to protect conductors.
- L. Expansion Fittings:
  - 1. Where raceways of any type pass a building or structure expansion joint, a standard expansion fitting shall be provided and installed. Review architectural and structural drawings for locations of expansion joints.
  - 2. Where raceways installed are subject to temperature swings, install expansion fittings spaced in accordance with manufacturer instructions and NFPA 70 requirements.
  - 3. Expansion fittings shall be compatible with the type of raceway being used.
- M. Raceways Embedded in Slabs: Install in middle 1/3 of slab thickness where practical and leave at least 2 inches of concrete cover.
  - 1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
  - 2. Space raceways laterally to prevent voids in concrete.
  - 3. Run conduit larger than 1-inch trade size parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
  - 4. Where turning up into cabinets, equipment, poles, etc.; transition from PVC to rigid metal elbows & raceway stub-ups, unless detailed otherwise.
- N. Underground raceways:
  - 1. Where turning up to cabinets, equipment, poles, etc.; transition from horizontal underground PVC to rigid metal for elbows & raceway stub-ups, unless detailed otherwise. The rigid metal transition underground shall include a minimum horizontal section of 24" in length.
  - 2. Stub-up Connections to Equipment:
    - a. Extend conduits through concrete floor/slab for connection to equipment.
    - b. For equipment subject to vibration or movement, FMC or LFMC may be used 6 inches above the floor to the equipment termination.
  - 3. With the exception of branch circuits, raceways run external to building foundation walls, shall be encased with a minimum of three (3") inches of concrete on all sides.

- O. Terminations:
  - 1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
  - 2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
  - 3. Where using boxes with concentric, eccentric, or over-sized knockouts; provide bonding bushings and jumpers. Size bonding jumpers in accordance with NEC Table 250-122, connecting to the box with ground lugs.
- P. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Label each end of pull wires with location of opposite end.
- Q. Telephone and Signal System Raceways, 2-Inch Trade Size and Smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
- R. Flexible Connections:
  - 1. Use maximum of 72 inches of flexible conduit for recessed and semi-recessed lighting fixtures.
  - 2. Use maximum of 24 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for all motors.
  - 3. Use LPMC in damp or wet locations.
- S. Install hinged-cover enclosures and cabinets plumb. Support at each corner.
- T. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound.
  - 1. Install raceway sealing fittings at the following points:
    - a. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
    - b. Where otherwise required by NFPA 70.
  - 2. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.
- U. Set floor boxes level and flush with finished floor surface.

### **3.3 PROTECTION**

- A. Provide final protection and maintain conditions that ensure coatings and finishes are without damage or deterioration at time of Final Acceptance.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

### **3.4 CLEANING**

- A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.
  - 1. Exposed threads on galvanized conduits and fittings, installed outdoors, shall be coated with galvanizing paint or equivalent protective coating.

### **END OF SECTION**

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**SECTION 26 0538  
WIRE MESH CABLE TRAYS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

**1.2 SECTION INCLUDES:**

- A. Continuous, rigid, welded steel wire mesh cable management system.
- B. Cable tray systems are defined to include, but are not limited to, straight sections, supports and accessories.

**1.3 SUMMARY**

- A. References:
  - 1. IEC 61537– Cable Tray Systems and Cable Ladder Systems for Cable Management.
  - 2. NEMA VE 1-2002/CSA C22.2 No. 126.1-02 – Metal Cable Tray Systems.
  - 3. ANSI/NFPA 70– National Electrical Code (NEC).
  - 4. TIA 569-A– Commercial Building Standard for Telecommunications Pathways & Spaces.
  - 5. ASTM A 510 - Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel.
  - 6. ASTM A 123 – Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

**1.4 SUBMITTALS**

- A. Product Data: Submit manufacturer's product data sheets for cable tray indicating dimensions, materials, and finishes, including UL Classification and NEMA/CSA Certification.
- B. Shop Drawings: Submit shop drawings indicating materials, finish, dimensions, accessories, layout, supports, splices, and installation details.

**1.5 QUALITY ASSURANCE**

- A. Source Limitations: Obtain cable tray components through one source from a single manufacturer.
- B. Comply with IEC 61537, Cable Tray Systems and Cable Ladder Systems for Cable Management.
- C. Comply with NEMA VE 1/CSA C22.2 No. 126.1, Metal Cable Tray Systems, for materials, sizes, and configurations; provide cCSAus Certificate and labels.

**PART 2 - PRODUCTS**

**2.1 MATERIALS AND FINISHES:**

- A. Cable Tray Materials: select one of the following:
  - 1. Carbon steel wire, ASTM A 510, Grade 1008. Wire welded, bent, and surface treated after manufacture.
- B. Cable Tray Finishes:
  - 1. Finish for Carbon Steel Wire after welding and bending of mesh:
  - 2. Hardware shall match the cable tray finish.
- C. Provide splices, supports, and other fittings necessary for a complete, continuously grounded system.
  - 1. Mesh: 2 x 4 inches.
  - 2. Straight Section Lengths: 10 feet.
- D. Cable Tray Size: As indicated on the drawings.

## **2.2 CABLE TRAY SUPPORTS & ACCESSORIES**

- A. Fittings/Supports: Supports shall include manufacturer recommended hardware. Place supports so that support span does not exceed manufacturer recommendations or code limitations.
  - 1. Suspended-mounting from building structure with 3/8" or 1/2" threaded rod.
  - 2. Threaded rod shall be covered by smooth metal conduit to a minimum of 12" above the top of the cable tray.
  - 3. Splices as recommended by cable tray manufacturer.
  - 4. Accessories:
    - a. Divider Strips, of same material and finish as cable tray, matching cable tray depth.
    - b. Cable Routing Accessories:
      - 1) Dropout: Bolt to tray; slotted design.
      - 2) Cable exit.
    - c. Support Accessories:
      - 1) J-Bolt kit to mount tray to 19" or 23" racks.
      - 2) Beam Supports: Beam Clamp: To clamp threaded rod to beam.
      - 3) Supports for Cables: Velcro straps to bundle cables.
    - d. Grounding Clamp to ground cable tray.
    - e. Roller: Cable Pulling Kit.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION:**

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of cable trays. Do not proceed with installation until unsatisfactory conditions have been corrected.

### **3.2 STORAGE**

- A. Storage and Handling: Avoid breakage, denting and scoring finishes. Damaged products shall not be installed. Store cable trays and accessories in original cartons and in clean dry space; protect from weather and construction traffic. Wet materials shall be unpacked and dried before storage.

### **3.3 COORDINATION**

- A. Coordinate layout and installation of cable tray with other installations. Revise locations and elevations from those indicated as required to suit field conditions and as approved by the Design Team.

### **3.4 INSTALLATION**

- A. Install cable tray level and plumb according to manufacturer's written instructions, coordination drawings, original design, and referenced standards.
  - 1. Cutting: Field-fabricate changes in direction & elevation by cutting & bending cable tray.
    - a. Cut cable tray wires in accordance with manufacturer's instructions.
    - b. Cable tray wires must be cut with side-action bolt cutters with offset head to ensure integrity of protective galvanic layer.
    - c. Remove burrs and sharp edges from cable trays.
- B. Install cable tray, so that the tray is accessible for cable installation and all splices are accessible for inspection and adjustment.
- C. Fasten cable tray supports to building structure .
  - 1. Tray shall be supported from both sides. Center mounted supports are not acceptable.
  - 2. Wall mounted supports as the sole support method are not acceptable. If wall mounted supports are used, support of the opposite side of the cable tray shall be by suspension from the building structure.
- D. Design fasteners and supports to carry cable tray, cables, and a concentrated load of 200 lb.



- E. Make connections to equipment with flanged fittings fastened to cable trays and to equipment. Support cable trays independent of fittings. Do not carry weight of cable trays on equipment enclosure.
- F. Install expansion connectors where cable trays cross building expansion joints and in cable tray runs that exceed recommended dimensions. Space connectors and set gaps according to applicable standard.
- G. Seal penetrations through fire and smoke barriers.
- H. Install cable trays with enough workspace to permit access for installing cables.

### **3.5 CABLE TRAY GROUNDING**

- A. Ground cable trays according to NFPA 70 unless additional grounding is specified.
- B. Cable trays with communications cable shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.

### **3.6 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:
  - 1. After installing cable trays, survey for compliance with requirements.
  - 2. Correct sharp corners, protuberances in cable trays, vibrations, and thermal expansion and contraction conditions, which may cause or have caused damage.
  - 3. Verify that the number, size, and voltage of cables in cable trays do not exceed that permitted by NFPA 70. Verify that communications are separated from power circuits by installation in separate cable trays.
  - 4. Verify that there are no intruding items such as pipes, hangers, or other equipment in the cable tray.
  - 5. Remove dust deposits, industrial process materials, trash of any description, and any blockage of tray ventilation.
  - 6. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorquing in suspect areas.
  - 7. Check for improperly sized or installed bonding jumpers.
  - 8. Check for missing, incorrect, or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.

### **3.7 PROTECTION**

- A. Protect installed cable trays and cables.
  - 1. Install temporary protection for cables in open trays to safeguard exposed cables against falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials and shall remain in place until the risk of damage is over.
  - 2. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.

**END OF SECTION**

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**SECTION 26 0553  
ELECTRICAL IDENTIFICATION**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes electrical identification materials and devices intended to comply with NFPA 70, OSHA standards, and authorities having jurisdiction.

**1.3 SUBMITTALS**

- A. Product Data:
  - 1. For each electrical identification product indicated.
  - 2. For double coated, adhesive tape product indicated.

**1.4 QUALITY ASSURANCE**

- A. Comply with NFPA 70 for color-coding.

**PART 2 - PRODUCTS**

**2.1 CABLE LABELS**

- A. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches.
- B. Underground-Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape.
  - 1. Not less than 6 inches wide by 4 mils thick.
  - 2. Compounded for permanent direct-burial service.
  - 3. Embedded continuous metallic strip or core.
  - 4. Printed legend indicating type of underground line.

**2.2 NAMEPLATES AND SIGNS**

- A. Engraved Plastic Nameplates and Signs: Engraving stock, plastic laminate, minimum 1/16" thick for signs up to 20 sq. in. and 1/8" thick for larger sizes.
- B. Fasteners for Nameplates and Signs:
  - 1. Two-part epoxy adhesive.
  - 2. Self-tapping, stainless-steel screws or stainless-steel rivets.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Identification Materials and Devices: Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding designations in the Contract Documents or with those required by codes and standards. Use consistent designations throughout Project.
- C. Sequence of Work: If identification is applied to surfaces that require finish, install identification after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before applying.
- E. Circuit Identification Labels on Boxes: Panel and circuit number.
  - 1. Interior Boxes:
    - a. Exposed: Pressure-sensitive, self-adhesive plastic label on cover.
    - b. Concealed:
      - 1) Pressure-sensitive, self-adhesive plastic label on cover; or
      - 2) Permanent marker on cover, legible in a standing position by Design Team and Owner.

2. Exterior Boxes:
  - a. Engraved plastic label on cover; and
  - b. Pressure-sensitive, self-adhesive plastic label inside cover.
- F. Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power, control, signal, and communication lines; install continuous underground-line warning tape located directly above line at 6 to 8 inches below finished grade. Where width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches overall, use a single line marker. Install line marker for underground wiring, both direct-buried cables and cables in raceway.
- G. Color-Coding of Phase, Neutral, and Ground Conductors: Use the following colors for service, feeder, and branch-circuit phase conductors:
 

1. Configuration	Phase A	Phase B	Phase C	Neutral	Ground
120/208-V, 3 Ph, 4W	Black	Red	Blue	White	Green
277/480-V, 3 Ph, 4W	Brown	Orange	Yellow	Gray	Green

  2. For conductors #6 AWG and smaller, factory apply color the entire length of conductors.
  3. For conductors #4 AWG and larger, field apply colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Use 1-inch-wide tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.
  4. At each panelboard, a color code legend shall be permanently posted corresponding to the conductors and voltage in that panelboard.
- H. Apply identification to conductors as follows:
  1. Conductors to Be Extended in the Future: Indicate source and circuit numbers.
  2. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color-coding to identify circuits' voltage and phase.
  3. Multiple Control and Communication Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color-coding, or cable marking tape.
- I. Equipment Identification Labels: Engraved plastic laminate. Install on each unit of equipment. For interior labels, use self-tapping stainless steel screws where sharp ends are protected. Otherwise, use rivets. For exterior and wet location labels, use Two-part epoxy adhesive. Apply labels for each unit of the following categories of equipment:
  1. Switchgear, switchboards, panelboards, electrical cabinets, and enclosures.
  2. Access doors and panels for concealed electrical items.
  3. Disconnect switches and enclosed circuit breakers.
  4. Transformers.
  5. Inverters.
  6. Contactors.
  7. Remote-controlled switches.
  8. Control devices and push-button stations.
  9. Motor-control centers and motor starters
  10. Emergency system boxes and enclosures.
  11. Transfer switches.
  12. Fire alarm control panels, master stations, control panels, local operator consoles, and power supplies.
  13. Emergency responder radio coverage system.
  14. Security-monitoring master stations and control panels.
  15. Telephone system equipment.
  16. Public address, intercom, and paging system equipment.
  17. Clock/program master equipment.
  18. Call system stations.

19. TV / audio / video system equipment.

Nameplate colors shall be:

1. Blue surface with white core for 208/120-V or 120/240-V equipment.
2. Black surface with white core for 480/277-V equipment.
3. Red surface with white core for emergency responder radio coverage system equipment.
4. Red surface with white core for fire alarm system equipment.
5. Burgundy surface with white core for security system equipment.
6. Green surface with white core for "emergency" system equipment.
7. Orange surface with white core for telephone system equipment.
8. Brown surface with white core for data system equipment.
9. White surface with black core for paging system equipment.
10. Purple surface with white core for TV system equipment.

**END OF SECTION**

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**SECTION 26 0923  
LIGHTING CONTROL DEVICES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes the following lighting control devices:
  - 1. Time switches.
  - 2. Outdoor photoelectric switches
  - 3. Switchbox-mounted occupancy and vacancy sensors.
  - 4. Indoor occupancy and vacancy sensors.
  - 5. Multipole lighting contactors.

**1.3 DEFINITIONS**

- A. PIR: Passive infrared.

**1.4 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show installation details for occupancy and light-level sensors.
  - 1. Plan indicating typical coverage area of each sensor.
  - 2. Interconnection diagrams showing field-installed wiring.
- C. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

**1.5 COORDINATION**

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

**2.2 GENERAL LIGHTING CONTROL DEVICE REQUIREMENTS**

- A. Line-Voltage Surge Protection: An integral part of the devices for 120- and 277-V solid-state equipment. For devices without integral line-voltage surge protection, field-mounting surge protection shall comply with IEEE C62.41 and with UL 1449.

**2.3 TIME SWITCHES**

- A. Manufacturers:
  - 1. Area Lighting Research, Inc.
  - 2. Fisher Pierce.
  - 3. Grasslin Controls Corporation.
  - 4. Intermatic, Inc.
  - 5. Paragon Electric Co.
  - 6. Sensor Worx.
  - 7. TORK.
  - 8. Watt Stopper (The).
- B. Digital Time Switches: Electronic, solid-state programmable units with alphanumeric display complying with UL 917.
  - 1. Contact Configuration: DPST.

2. Contact Rating: 30-A inductive or resistive, 240-V ac.
3. Program: Two channel minimum, 8 on-off set points on a 24-hour schedule and an annual holiday schedule that overrides the weekly operation on holidays.
4. Circuitry: Allow connection of a photoelectric relay as substitute for on and off function of a program.
5. Astronomical Time: All channels.
6. Battery Backup: For schedules and time clock.

## **2.4 OUTDOOR PHOTOELECTRIC SWITCHES**

- A. Manufacturers:
  1. Area Lighting Research, Inc.
  2. Fisher Pierce.
  3. Grasslin Controls Corporation.
  4. Intermatic, Inc.
  5. Paragon Electric Co.
  6. TORK.
  7. Touchplate Technologies, Inc.
  8. Watt Stopper (The).
- B. Description: Solid state, with DPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, microprocessor input, and complying with UL 773A.
  1. Light-Level Monitoring Range: 1.5 to 10 fc (16 to 108 lx), with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
  2. Time Delay: 15-second minimum, to prevent false operation.
  3. Surge Protection: Metal-oxide varistor type, complying with IEEE C62.41 for Category A1 locations.
  4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the North sky exposure.

## **2.5 SWITCHBOX-MOUNTED OCCUPANCY AND VACANCY SENSORS**

- A. Manufacturers:
  1. Cooper Controls.
  2. Hubbell Lighting Inc.
  3. Leviton Mfg. Company Inc.
  4. Watt Stopper (The).
- B. Description: Dual technology, ultrasonic and PIR type, with integral power-switching contacts rated for 800 W at 120-V ac and 1200 W at 277-V ac, minimum; suitable for electronic ballasts, LED drivers, or 1/6-hp motors.
  1. Field configurable occupancy sensing or vacancy sensing operating modes. Operation:
    - a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
    - b. Vacancy Sensor: Unless otherwise indicated, lights are manually turned on and sensor turns lights off when the room is unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
  2. Include ground wire.
- C. Single Relay Unit: Device contains one relay for controlling load circuit.
  1. Design Basis: Hubbell # LHMTS1.
  2. One On-Off button for manual control.
- D. Dual Relay Unit: Device contains two relays for controlling independent lighting loads or circuits.
  1. Design Basis: Hubbell #LHMTD2.



2. Two On-Off buttons for manual control.
- E. Dimmer Unit:
  1. Design Basis: Legrand / WattStopper #DW-311.
  2. Dimming Control Signal: 0-10 VDC.
  3. Suitable for multi-way control from up to four locations.

## 2.6 INDOOR OCCUPANCY AND VACANCY SENSORS

- A. Manufacturers:
  1. Cooper Controls.
  2. Hubbell Lighting Inc.
  3. Leviton Mfg. Company Inc.
  4. Watt Stopper (The).
- B. General Description: Wall- or ceiling-mounting, as indicated on the drawings; low-voltage solid-state units with separate line-voltage relay units.
  1. Configurable occupancy sensing or vacancy sensing operating modes. Operation:
    - a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
    - b. Vacancy Sensor: Unless otherwise indicated, lights are manually turned on and sensor turns lights off when the room is unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
  2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
  3. Relay Units: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
    - a. Where indicated for 277-V ac lighting systems, provide additional relay units where required for simultaneous control of 120-V ac exhaust fans.
  4. Mounting:
    - a. Sensor: Suitable for mounting in any position on a standard outlet box.
    - b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
    - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
  5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
  6. Bypass Switch: Override the on function in case of sensor failure.
- C. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on and off functions shall be selectable in the field by operating controls on unit.
  1. Sensitivity Adjustment: Separate for each sensing technology.
  2. Detector Sensitivity: Detect occurrences of 6-inch minimum movement of any portion of a human body that presents a target of at least 36 sq. in., and detect a person of average size and weight moving at least 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/second.
  3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch-high ceiling.
- D. Design Basis: Hubbell # OMNIDT2000. If room size is significantly smaller than 2000 sq. ft., evaluate the use of a unit with applicably sized reduced range.

## 2.7 MULTIPOLE LIGHTING CONTACTORS

- A. Manufacturers:

1. Allen-Bradley/Rockwell Automation.
  2. Cutler-Hammer; Eaton Corporation.
  3. GE Industrial Systems.
  4. Siemens.
  5. Square D.
- B. Description: Electrically operated and mechanically held, complying with NEMA ICS 2 and UL 508. Contactors shall be provided as packaged assembly in factory enclosure.
1. Current Rating for Switching: 30A, unless noted otherwise.
  2. Control-Coil Voltage: Match control power source.

### **PART 3 - EXECUTION**

#### **3.1 SENSOR INSTALLATION**

- A. Install and aim sensors in locations to achieve at least 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

#### **3.2 WIRING INSTALLATION**

- A. Wiring Method: Comply with Section "Conductors and Cables".
- B. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

#### **3.3 IDENTIFICATION**

- A. Identify components and power and control wiring according to Section "Electrical Identification".
- B. Label time switches and contactors with a unique designation.

#### **3.4 FIELD QUALITY CONTROL**

- A. Perform the following field tests and inspections and prepare test reports:
1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
  2. Operational Test: Verify actuation of each sensor and adjust time delays.
- B. Remove and replace lighting control devices where test results indicate that they do not comply with specified requirements and control intent.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

#### **3.5 ADJUSTING**

- A. Occupancy Adjustments: When requested within 6 months from date of Final Acceptance, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.

**END OF SECTION**

**SECTION 26 2200  
DRY-TYPE TRANSFORMERS (600 V AND LESS)**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:
  - 1. Distribution transformers.

**1.3 SUBMITTALS**

- A. Product Data Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.
- B. Shop Drawings: Wiring and connection diagrams.
- C. Output Settings Reports: Record of tap adjustments specified in Part 3.

**1.4 QUALITY ASSURANCE**

- A. Comply with IEEE C 57.12.91, "Standard Test Code for Dry-Type Distribution and Power Transformers".
- B. Comply with IEEE C 57.96, "Guide for Loading Dry-Type Distribution and Power Transformers".
- C. Comply with IEEE C 57.110, "Recommended Practice for Establishing Transformer Capability When Supplying Non-sinusoidal Load Currents".
- D. Energy-Efficient Transformers Rated 15 kVA and Larger: Certified as meeting NEMA TP 1, Class 1 efficiency levels when tested according to NEMA TP 2.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

**1.6 COORDINATION**

- A. Coordinate size and location of concrete bases.
- B. Coordinate installation of wall-mounting and structure-hanging supports.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Acme Electric Corporation; Power Distribution Products Division.
  - 2. Eaton / Cutler-Hammer.
  - 3. GE Electrical Distribution & Control.
  - 4. Hammond Power Solutions.
  - 5. Siemens Energy & Automation, Inc.
  - 6. Sola/Hevi-Duty Electric.
  - 7. Square D / Schneider.

**2.2 MATERIALS**

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Cores: Grain-oriented, non-aging silicon steel.

- C. Coils: Continuous windings without splices, except for taps.
  - 1. Internal Coil Connections: Brazed or pressure type.
  - 2. Coil Material: Copper.

### 2.3 DISTRIBUTION TRANSFORMERS

- A. Comply with NEMA ST 20, and list and label as complying with UL 1561.
- B. Cores: One leg per phase.
- C. Enclosure:
  - 1. Indoors: Ventilated, NEMA 250, Type 2.
  - 2. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
- D. Indoor Transformer Enclosure Finish: Comply with NEMA 250 for "Indoor Corrosion Protection"; Finish Color: Gray.
- E. Outdoor Transformer Enclosure Finish: Comply with NEMA 250 for "Outdoor Corrosion Protection"; Finish Color: Gray.
- F. Efficiency: Meet or exceed DOE 2016 efficiency standards for distribution transformers..

#### Distribution Transformer Energy Efficiency Minimum Requirements

	Single Phase	Three Phase
<u>kVA</u>	<u>Efficiency</u>	<u>Efficiency</u>
15	97.7%	97.89%
25	98.0%	-
30	-	98.23%
37.5	98.2%	-
45	-	98.40%
50	98.3%	98.60%
75	98.5%	98.60%
100	98.6%	-
112.5	-	98.74%
150	-	98.83%
167	98.7%	-
225	-	98.94%
250	98.8%	-
300	-	99.02%
333	98.9%	-
500	-	99.14%
750	-	99.23%
1000	-	99.28%

- G. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 80 deg C rise.
- H. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above, and one 5 percent tap below normal full capacity.
- I. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above, and two 2.5 percent taps below normal full capacity.
- J. Wall Brackets: Manufacturer's standard brackets.

### 2.4 SOURCE QUALITY CONTROL

- A. Test and inspect transformers according to IEEE C57.12.91.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
- C. Examine walls and floors for suitable mounting conditions where transformers will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 INSTALLATION**

- A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.
- B. Install floor-mounting transformers level on concrete bases. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit and 4 inches high. Reinforce concrete bases with welded wire fabric.

#### **3.3 CONNECTIONS**

- A. Ground equipment according to Section "Grounding and Bonding".
- B. Connect wiring according to Section "Conductors and Cables".

#### **3.4 ADJUSTING**

- A. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 5 percent.
- B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

**END OF SECTION**

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**SECTION 26 2416  
PANELBOARDS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Distribution panelboards.
  - 2. Lighting and appliance branch-circuit panelboards.

**1.3 DEFINITIONS**

- A. GFCI: Ground-fault circuit interrupter.
- B. GFEP: Ground-fault equipment protection.
- C. RMS: Root mean square.

**1.4 SUBMITTALS**

- A. Product Data: For each type of panelboard, overcurrent protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
  - 1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:
    - a. Enclosure types and details for types other than NEMA 250, Type 1.
    - b. Trim types and details.
    - c. Bus configuration, current, and voltage ratings.
    - d. Short-circuit current rating of panelboards and overcurrent protective devices.
    - e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
- C. Panelboard Directories: For installation in panelboards.
- D. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals.

**1.5 QUALITY ASSURANCE**

- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.
- B. Comply with NEMA PB 1.

**1.6 COORDINATION**

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

**1.7 EXTRA MATERIALS**

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Keys: Six spares for each type of panelboard cabinet lock.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Panelboards, Overcurrent Protective Devices, and Accessories:
  - a. ABB / G.E.
  - b. Eaton Corporation; Cutler-Hammer Products.
  - c. Siemens Energy & Automation, Inc.
  - d. Square D.

## 2.2 MANUFACTURED UNITS

- A. Enclosures: Flush- and surface-mounted cabinets, as scheduled in the drawings.
  1. Rated for environmental conditions at installed location.
    - a. Typical Indoor Locations: NEMA 250, Type 1.
      - 1) Front Hinged Cover: Entire front trim hinged to box with full-length piano hinge, and with standard door within hinged trim cover.
      - 2) Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
    - b. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
      - 1) Front Hinged Cover: Entire front trim hinged to box with full-length piano hinge, and with standard door within hinged trim cover.
    - c. Outdoor Locations: NEMA 250, Type 3R.
    - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
  2. Front Cover: Doors with concealed hinges; secured with flush latch with tumbler lock; keyed alike.
  3. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.
- B. Phase Buses:
  1. Material: Hard-drawn copper, 98 percent conductivity.
- C. Ground and Neutral Bars:
  1. Material: Copper.
  2. Equipment Ground Bar: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.
  3. Neutral Bar: Neutral bar shall be fully sized to match the panel ampere rating. Neutral bar terminal quantity shall be sized adequately for the quantity of feeder and branch-circuit neutral conductors.
- D. Conductor Connectors: Suitable for use with conductor material.
  1. Main and Neutral Lugs: Mechanical type.
  2. Ground Lugs and Bus Configured Terminators: Mechanical or compression type.
- E. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.
- F. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices. These locations will be indicated as SPACE on the panel schedules in the drawings.

## 2.3 PANELBOARD SHORT-CIRCUIT RATING

- A. Fully rated to interrupt symmetrical short-circuit current available at terminals.

## 2.4 OVERCURRENT PROTECTIVE DEVICES

- A. Main Overcurrent Protective Devices: Circuit breaker, where scheduled.
- B. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- C. Molded-Case Circuit Breaker: UL 489, with interrupting capacity to meet available fault currents.
  1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.



2. GFCI Circuit Breakers: 5-mA trip sensitivity for personnel protection; single- and two-pole configurations.
  3. GFEP Circuit Breakers: 30-mA trip sensitivity for equipment protection; single- and two-pole configurations.
  4. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
  5. Electronic trip-unit circuit breakers shall have RMS sensing; field-replaceable rating plug; and with the following field-adjustable settings:
    - a. Instantaneous trip.
    - b. Long- and short-time pickup levels.
    - c. Long- and short-time time adjustments.
    - d. Ground-fault pickup level, time delay, and  $I^2t$  response.
- D. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
  2. Multipole units enclosed in a single housing or factory-assembled to operate as a single unit.
  3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
  4. Shunt Trip: Where required or indicated, 120-V trip coil energized from separate circuit.

## 2.5 INSTRUMENTATION

- A. Instrument Transformers: NEMA EI 21.1, IEEE C57.13, and the following:
1. Potential Transformers: Secondary voltage rating of 120 V and NEMA accuracy class of 0.3 with burdens of W, X, and Y.
  2. Current Transformers: Ratios shall be as indicated with accuracy class and burden suitable for connected relays, meters, and instruments.
  3. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kV.
- B. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:
1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:
    - a. Phase Currents, Each Phase: Plus or minus 1 percent.
    - b. Phase-to-Phase Voltages, Three Phase: Plus or minus 1 percent.
    - c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 1 percent.
    - d. Kilowatts: Plus or minus 2 percent.
    - e. Kilovars: Plus or minus 2 percent.
    - f. Power Factor: Plus or minus 2 percent.
    - g. Frequency: Plus or minus 0.5 percent.
    - h. Kilowatt Demand: Plus or minus 2 percent; demand interval programmable from 5 to 60 minutes.
    - i. Accumulated Energy, Kilowatt Hours: Plus or minus 2 percent. Accumulated values unaffected by power outages up to 72 hours.
  2. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door.
  3. Communications: BACnet protocol. Coordinate specific requirements with building direct digital control (DDC) vendor.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Mount top of trim 74 inches above finished floor, unless otherwise indicated.

- C. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.
- D. Install overcurrent protective devices and controllers. Set field-adjustable circuit-breaker trip ranges. Prepare documentation of circuit breaker trip settings for Owner record documents.
- E. Panel breaker configurations shall be installed as indicated on the panel schedules or as noted. Breaker position revisions will not be accepted unless approved in writing by the Engineer.
- F. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- G. Install filler plates in unused spaces.
- H. For flush mounted panelboards and unless noted otherwise, stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future.

### **3.2 IDENTIFICATION**

- A. Create a directory to indicate installed circuit loads. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- B. Panelboard Nameplates: Label each panelboard with laminated-plastic nameplate mounted as specified in Section "Electrical Identification".

### **3.3 CONNECTIONS**

- A. Ground equipment according to Section "Grounding and Bonding".
- B. Connect wiring according to Section "Conductors and Cables".

### **3.4 FIELD QUALITY CONTROL**

- A. Prepare for acceptance tests as follows:
  - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
  - 3. Neutral-ground bond testing: After all fixtures, devices and equipment are installed and all connections completed to each panel, the CONTRACTOR shall disconnect the neutral feeder conductor from the neutral bar and take a megger reading between the neutral bar and grounded enclosure. If this reading is less than 25 mega-ohms, the CONTRACTOR shall disconnect the branch circuit neutral wires from the neutral bar. The CONTRACTOR shall then test each one separately to the panel until the low reading ones are found. The CONTRACTOR shall correct troubles, re connect, and re test until at least 25 mega-ohms from the neutral bar to the grounded panel can be achieved with only the neutral feeder disconnected.
- B. Perform the following field tests and inspections and prepare test reports:
  - 1. Perform each electrical test and visual and mechanical inspection stated in manufacturer's installation instructions for molded-case circuit breakers.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

### **3.5 CLEANING**

- A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

### **END OF SECTION**

**SECTION 26 2726  
WIRING DEVICES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Single and duplex receptacles and ground-fault circuit interrupter receptacles.
  - 2. Single- and double-pole snap switches and dimmer switches.
  - 3. Device wall plates.
  - 4. Floor service outlets.

**1.3 DEFINITIONS**

- A. GFCI: Ground-fault circuit interrupter.

**1.4 SUBMITTALS**

- A. Product Data: For each type of product indicated.

**1.5 QUALITY ASSURANCE**

- A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer.

**1.6 COORDINATION**

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Wiring Devices:
    - a. Bryant Electric, Inc./Hubbell Subsidiary.
    - b. Eagle Electric Manufacturing Co., Inc.
    - c. Hubbell Incorporated; Wiring Device-Kellems.
    - d. Leviton Mfg. Company Inc.
    - e. Lutron.
    - f. Pass & Seymour/Legrand; Wiring Devices Div.
  - 2. Floor Service Outlets:
    - a. Hubbell Incorporated; Wiring Device-Kellems.
    - b. Pass & Seymour/Legrand; Wiring Devices Div.
    - c. Square D/Groupe Schneider NA.
    - d. Thomas & Betts Corporation.
    - e. Wiremold Company (The).

**2.2 RECEPTACLES**

- A. Straight-Blade-Type Receptacles: Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596, and UL 498.
- B. Straight-Blade and Locking Receptacles:
  - 1. Federal Specification grade W-C-596.
  - 2. Arranged for back and side wiring with brass screws.
  - 3. Grounding type with hex head ground screw terminal.
  - 4. 15-amp and 20-amp, 125-Volt and 250-Volt receptacles in damp or wet locations shall be listed weather-resistant type.

5. Receptacles shall accommodate back and side wiring and shall be grounding type with separate single or double grounding screw terminals.
- C. Tamper-Resistant Convenience Receptacles, 125 V, 15 & 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.
- D. GFCI Receptacles:
  1. Straight blade, feed-through type, Federal Specification grade W-C-596, with integral NEMA WD 6, Configuration 5-20R duplex receptacle.
  2. Comply with UL 498 and UL 943.
  3. Design units for installation in a 2-3/4-inch-deep outlet box without an adapter.
- E. Industrial Heavy-Duty Pin and Sleeve Devices: Comply with IEC 309-1.

## 2.3 SWITCHES

- A. Toggle Switches: Comply with UL 20.
  1. Federal Specification grade W-S-896, quiet type without the use of mercury switches.
  2. Arranged for back and side wiring with brass screws.
  3. Grounding type with hex head ground screw terminal.
  4. Types:
    - a. Single-pole.
    - b. Two-pole.
    - c. Three-way.
    - d. Four-way.
    - e. Key operated: Factory supplied key in lieu of switch handle.
    - f. Double-throw, momentary-contact, center-Off: For use as equipment control.
- B. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on/off switches and audible frequency and EMI/RFI filters.
  1. Control: Continuously adjustable slider; with single-pole or three-way switching to suit connections.

## 2.4 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
  1. Size: All plates shall be oversized / jumbo with matching vertical dimension.
  2. Plate-Securing Screws: Metal with head color to match plate finish.
  3. Material for Finished Spaces: 0.035-inch- (1-mm-) thick, satin-finished stainless steel.
  4. Material for Unfinished Spaces: Galvanized steel.
  5. Material for Wet Locations: Cast aluminum, weatherproof, extra-duty rated, "in-use" type. Receptacle box covers shall be weatherproof whether or not a cord & plug are inserted or not.
  6. Toggle Switch Serving as a Disconnect: Wallplate shall be configured with brackets on both sides of the switch to accommodate a padlock to secure the switch in the Off position.

## 2.5 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: Rectangular, die-cast aluminum with satin finish.
- D. Power Receptacle: NEMA WD 6, Configuration 5-20R, unless otherwise indicated.
- E. Voice and Data Communication Outlet: Modular, keyed, color-coded, RJ-45 jacks for data cable, unless otherwise indicated.

## 2.6 FINISHES

- A. Color:
  1. Wiring Devices Connected to Normal Power System: White, unless otherwise indicated or required by NFPA 70.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Install devices and assemblies level, plumb, and square with building lines.
  - 1. Installation height shall be as detailed in the drawings.
- B. Install tamper-resistant receptacles at locations as required by the NEC and/or the local authority having jurisdiction.
- C. Install unshared neutral conductors online and load side of dimmers according to manufacturers' written instructions.
- D. Arrangement of Devices: Mount flush unless noted otherwise:
  - 1. Receptacles over counters, backsplashes, etc. shall be mounted with long dimension horizontal.
  - 2. Otherwise, unless noted differently, mount with long dimension vertical, and with grounding terminal of receptacles on top.
  - 3. Group adjacent switches under single, multigang wall plates.
- E. Remove wall plates and protect devices and assemblies during painting.
- F. Adjust locations of floor service outlets to suit arrangement of partitions and furnishings. Coordinate final placement with Architect and Owner.

#### **3.2 IDENTIFICATION**

- A. Comply with Section "Electrical Identification."
  - 1. Receptacles and Switches: Identify panelboard and circuit number from which served. Use hot, stamped / thermal printing with black-filled lettering on face of plate, and durable wire markers inside outlet boxes.

#### **3.3 CONNECTIONS**

- A. Ground equipment according to Section "Grounding and Bonding".
- B. Connect wiring according to Section "Conductors and Cables".

#### **3.4 FIELD QUALITY CONTROL**

- A. Perform the following field tests and inspections:
  - 1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.
  - 2. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
- B. Remove malfunctioning units, replace with new units, and retest as specified above.

**END OF SECTION**

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**SECTION 26 2816  
ENCLOSED SWITCHES AND CIRCUIT BREAKERS**

**1.1 SUMMARY**

- A. Section Includes:
  - 1. Fusible switches.
  - 2. Molded-case circuit breakers (MCCBs).
  - 3. Enclosures.

**1.2 DEFINITIONS**

- A. GFCI: Ground-fault circuit-interrupter for life safety.
- B. GFEP: Ground-fault circuit-interrupter for equipment protection.

**1.3 ACTION SUBMITTALS**

- A. Product Data:
  - 1. For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
  - 2. Enclosure types and details for types other than UL 50E, Type 1.
  - 3. Current and voltage ratings.
  - 4. Short-circuit current ratings (interrupting and withstand, as appropriate).
  - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
- B. Shop Drawings: For enclosed switches and circuit breakers.
  - 1. Include plans, elevations, sections, details, and attachments to other work.

**1.4 CLOSEOUT SUBMITTALS**

- A. Warranty documentation.
- B. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. If Section "Operation and Maintenance Data" is included in the project manual, in addition to items there, include the following:
  - 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
  - 2. Time-current curves, including selectable ranges for each type of circuit breaker.
  - 3. Circuit breaker trip settings.

**1.5 WARRANTY**

- A. Special Installer Extended Warranty: Installer warrants that fabricated and installed enclosed switches and circuit breakers perform in accordance with specified requirements and agrees to repair or replace components or products that fail to perform as specified within warranty period.
  - 1. Warranty Period: Two years from date of Final Acceptance; full coverage for labor, materials, and equipment.

**PART 2 - PRODUCTS**

**2.1 GENERAL REQUIREMENTS**

- A. Source Limitations: Obtain products from single manufacturer.
- B. Manufacturers:
  - 1. ABB / G.E.
  - 2. Eaton Corporation; Cutler-Hammer Products.
  - 3. ESL Power Systems.
  - 4. Hubbell.
  - 5. Legrand.
  - 6. Siemens Energy & Automation, Inc.

7. Square D/Group Schneider.
- C. Product Selection for Restricted Space: Where drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- D. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.

## **2.2 FUSIBLE SWITCHES**

- A. Type HD, Heavy Duty:
  1. Single throw.
  2. Pole quantity, voltage, and Amperage as required for circuit controlled.
  3. UL 98 and NEMA KS 1, horsepower rated. Where fused, clips or bolt pads shall accommodate fuses rated for the nameplate rating of equipment controlled.
  4. Lockable handle with provisions to lock in either the On or OFF position and interlocked with cover in closed position.
- B. Accessories:
  1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
  3. Service-Rated Switches: Labeled for use as service equipment.
  4. Lugs: Suitable for number, size, and conductor material as indicated in the drawings.

## **2.3 DOUBLE THROW SWITCHES**

- A. Pole quantity, voltage, and Amperage as required for circuit controlled.
- B. Lockable handle with capability to accept three padlocks and interlocked with cover in closed position.
- C. Accessories:
  1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
  3. Service-Rated Switches: Labeled for use as service equipment.
  4. Lugs: Suitable for number, size, and conductor material as indicated in the drawings.
  5. Connectors for generator connection as indicated in the drawings.

## **2.4 MOLDED-CASE CIRCUIT BREAKERS**

- A. Standard: Comply with UL 489 with required interrupting capacity for available fault currents.
- B. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- C. Electronic Trip Circuit Breakers: Field-replaceable rating plug, RMS sensing, with the following field-adjustable settings:
  1. Instantaneous trip.
  2. Long- and short-time pickup levels.
  3. Long- and short-time time adjustments.
  4. Ground-fault pickup level, time delay, and I-squared t response.
- D. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6 mA trip).
- E. GFEP Circuit Breakers: With Class B ground-fault protection (30 mA trip).
- F. Features and Accessories:



1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Suitable for number, size, trip ratings, and conductor material.

## **2.5 ENCLOSURES**

- A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, UL 50E, and UL 50, to comply with environmental conditions at installed location.
- B. Enclosure Finish:
  1. Indoor Locations: UL 50E Type 1.
  2. Outdoor Locations: UL 50E Type 3R.
- C. Conduit Entry: UL 50E Types 4X and 12 enclosures may not contain knockouts.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected. Commencement of work will indicate Installer's acceptance of areas and conditions as satisfactory.

### **3.2 INSTALLATION**

- A. Comply with manufacturer's published instructions.
- B. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- C. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
  1. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
  2. Install fuses in fusible devices.

### **3.3 IDENTIFICATION**

- A. Comply with requirements in Section 260553 "Electrical Identification."
  1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
  2. Label each enclosure with engraved-plastic nameplate.

### **3.4 FIELD QUALITY CONTROL**

- A. Tests and Inspections:
  1. Visual and Mechanical Inspection:
    - a. Verify that equipment nameplate data are as described in the Specifications and shown on Drawings.
    - b. Inspect physical and mechanical condition.
    - c. Inspect anchorage, alignment, grounding, and clearances.
    - d. Verify that unit is clean. Clean interior with vacuum, not compressed air.
    - e. Inspect exposed surfaces and repair damaged finishes.
    - f. Inspect bolted electrical connections for high resistance. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of lowest value.
    - g. Switches:
      - 1) Verify blade alignment, blade penetration, travel stops, and mechanical operation.
      - 2) Verify that fuse sizes and types match the Specifications, Drawings, and equipment nameplate rating requirements.

- 3) Verify that each fuse has adequate mechanical support and contact integrity.
  - h. Circuit Breakers:
    - 1) Operate circuit breaker to ensure smooth operation.
    - 2) Inspect operating mechanism, contacts, and chutes in unsealed units.
  2. Electrical Tests:
    - a. Perform resistance measurements through bolted connections with low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of lowest value.
    - b. Circuit Breakers:
      - 1) Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data. Minimum pickup voltage of shunt trip and close coils must be as indicated by manufacturer.
  - B. Nonconforming Work:
    1. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
    2. Remove and replace defective units and retest.
- 3.5 ADJUSTING**
- A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.
- 3.6 PROTECTION**
- A. After installation, protect enclosed switches and circuit breakers from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

**END OF SECTION**

**SECTION 26 4313  
SURGE PROTECTIVE DEVICES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes UL 1449 Type 2 surge protective devices for low-voltage power.

**1.3 SUBMITTALS**

- A. Product Data: For each type of product indicated. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.
- B. Product Certificates: Signed by manufacturers of surge protective devices, certifying that products furnished comply with the following testing and labeling requirements:
  - 1. UL 1283 certification.
  - 2. UL 1449 listing and classification.
- C. Maintenance Data: For surge protection devices to include in maintenance manuals.
- D. Warranties: Special warranties specified in this Section.

**1.4 QUALITY ASSURANCE**

- A. Source Limitations: Obtain suppression devices and accessories through one source from a single manufacturer.
- B. IEEE Compliance: Comply with:
  - 1. IEEE C62.41.1, "Guide on the Surge Environment in Low-Voltage (1000V and less) AC Power Circuits".
  - 2. IEEE C62.41.2, "Recommended Practice on Characterization of Surges in Low-Voltage (1000V and less) AC Power Circuits".
  - 3. IEEE C62.45, "Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and less) AC Power Circuits".
  - 4. IEEE C62.72, "Guide for the Application of Surge Protective Devices for Low-Voltage (1000V and less) AC Power Circuits".
  - 5. IEEE C62.45, "Standard Test Specifications for Surge Protective Devices for Low-Voltage (1000V and less) AC Power Circuits".
- C. NEC Compliance: Comply with NEC 285, "Surge Protective Devices".
- D. UL Compliance: Comply with:
  - 1. UL 1283, "Electromagnetic Interference Filters".
  - 2. UL 1449, "Transient Voltage Surge Suppressors": latest edition.

**1.5 PROJECT CONDITIONS**

- A. Placing into Service: Do not energize or connect service entrance equipment and panelboards to their sources until the surge protective devices are installed and connected.
- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Design Team not less than two weeks in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Owner's written permission.

**1.6 COORDINATION**

- A. Verify voltage rating of system to be protected by surge protective device.
- B. Coordinate location of field-mounted surge suppressors to allow adequate clearances for maintenance.

## 1.7 WARRANTY

- A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of surge suppressors that fail in materials or workmanship within five years from date of Final Acceptance.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. ABB / Current Technology, Inc.
  - 2. ASCO.
  - 3. Thor Systems, Inc.

### 2.2 SERVICE ENTRANCE SUPPRESSORS

- A. Manufacturer Series:
  - 1. ABB / Current Technology #TG3 Series.
  - 2. ASCO #460 Series.
  - 3. Thor Systems #TSri Series.
- B. Include the following features and accessories:
  - 1. LED indicator lights for power and protection status.
  - 2. Surge Rating: 100kA per mode / 200KA per phase.
  - 3. ANSI / UL 1449 VPR:
    - a. 120/208V: 800V maximum (L-N, L-G, N-G), 1200V maximum (L-L).
    - b. 277/480V: 1200V maximum (L-N, L-G, N-G), 2000V maximum (L-L).
  - 4. Enclosures: NEMA 1.
  - 5. Surge-event operations counter.
- C. Connection Means: Permanently wired.
- D. Protection modes:
  - 1. Line to Neutral.
  - 2. Line to Ground.
  - 3. Neutral to Ground.

### 2.3 PANELBOARD SUPPRESSORS

- A. Manufacturer Series:
  - 1. ABB / Current Technology #CGP Series.
  - 2. ASCO #440 Series.
  - 3. Thor Systems #TSni Series.
- B. Include the following features and accessories:
  - 1. LED indicator lights for power and protection status.
  - 2. Surge Rating: 50kA per mode.
  - 3. ANSI / UL 1449 VPR:
    - a. 120/208V: 800V maximum (L-N, L-G, N-G), 1200V maximum (L-L).
    - b. 277/480V: 1200V maximum (L-N, L-G, N-G), 2000V maximum (L-L).
  - 4. Enclosures: NEMA 1.
  - 5. Surge-event operations counter.
- C. Connection Means: Permanently wired.
- D. Protection modes:
  - 1. Line to Neutral.

2. Line to Ground.
3. Neutral to Ground.

## **2.4 ENCLOSURES**

- A. NEMA 250, with type matching the enclosure of panel or device being protected.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION OF SURGE PROTECTIVE DEVICES**

- A. Install devices at service entrance on load side, with ground lead bonded to service entrance ground. Use conductors between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length.
  1. Provide multipole, 60-A circuit breaker as a dedicated disconnect for the suppressor, unless otherwise indicated
- B. Install devices for panelboards with conductors between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
  1. Provide multipole, 30-A circuit breaker as a dedicated disconnect for the suppressor, unless otherwise indicated.

### **3.2 CONNECTIONS**

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### **3.3 FIELD QUALITY CONTROL**

- A. Testing: Perform the following field quality-control testing:
  1. After installing surge protective devices, but before electrical circuitry has been energized, test for compliance with requirements.
  2. Complete startup checks according to manufacturer's written instructions.
- B. Repair or replace malfunctioning units. Retest after repairs or replacements are made.

**END OF SECTION**

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**SECTION 26 5119  
LED INTERIOR LIGHTING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. *Energy Efficient Lighting Guidance Document for New Construction and Retrofits*, North Carolina State Construction Office.

**1.2 SUMMARY**

- A. Section includes interior LED luminaires, LED luminaires mounted on exterior building surfaces, materials, finishes, supports.
- B. Related Requirements:
  - 1. Section "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting contactors.

**1.3 DEFINITIONS**

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

**1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Arrange in order of luminaire callout designation.
  - 2. Include data on features, accessories, and finishes.
  - 3. Include physical description and dimensions of luminaires.
  - 4. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
  - 5. Include emergency lighting units, including batteries, chargers, photometric performance data.

**1.5 INFORMATIONAL SUBMITTALS**

- A. Sample warranty.

**1.6 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

**1.7 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. LED Arrays: Three for every 100 of each type and rating installed. Furnish at least one of each type.
  - 2. LED Drivers: Three for every 100 of each type and rating installed. Furnish at least one of each type.
  - 3. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
  - 4. Globes and Guards: One for every 50 of each type and rating installed. Furnish at least one of each type.

**1.8 QUALITY ASSURANCE**

- A. Provide luminaires from a single manufacturer for each luminaire type.
- B. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

**1.9 DELIVERY, STORAGE, AND HANDLING**

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

**1.10 WARRANTY**

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: 5 years from date of Final Acceptance

**PART 2 - PRODUCTS**

**2.1 LUMINAIRE REQUIREMENTS**

- A. Standards:
  - 1. Design Lights Consortium (DLC) qualified products list or ENERGY STAR certified.
  - 2. UL 1598, Standard for Luminaires.
  - 3. Recessed luminaires shall comply with NEMA LE 4.
  - 4. UL Listing: Listed for damp or wet location as applicable.
  - 5. 2.0 kV surge protection integral to the driver.
- B. CRI minimum of 80 CCT.
- C. Rated lamp life of 50,000 hours minimum to L70.
- D. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- E. Internal driver.
- F. Input Voltage Tolerance: +/- 10% of nominal rated voltage.

**2.2 RECESSED CAN DOWNLIGHT**

- A. Universal mounting bracket.
- B. Integral junction box with conduit fittings.
- C. Fixtures installed in the building thermal envelope shall be:
  - 1. IC rated.
  - 2. Labeled as having an air leakage rate of not more than 2.0 cfm when tested in accordance with ASTM E283 at a 1.57 psf pressure differential.
  - 3. Sealed with a gasket between the housing and interior wall or ceiling covering.
- D. Fixtures and associated drivers that are installed in hard ceilings shall be fully accessible without a need for access panels.

**2.3 EMERGENCY LIGHTING UNITS**

- A. General: Self-contained units complying with UL 924.
  - 1. LED lamp heads.
  - 2. Battery: Sealed, maintenance-free, nickel-cadmium or nickel metal hydride type with minimum 10-year nominal life and special warranty. Battery sized to provide emergency illumination for not less than 90 minutes.
  - 3. Charger: Fully automatic, solid-state type with sealed transfer relay.
  - 4. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.



5. Integral Time-Delay Relay: Holds unit on for fixed interval when power is restored after an outage; time delay permits high-intensity-discharge lamps to restrike and develop adequate output.

## **2.4 EXIT SIGNS**

- A. General: Comply with UL 924; for sign colors and lettering size, comply with authorities having jurisdiction.
- B. Lamps for AC Operation: Light-emitting diodes, 70,000 hours minimum of rated lamp life.
- C. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
  1. Battery: Sealed, maintenance-free, nickel-cadmium or nickel metal hydride type with special warranty. Battery sized to provide emergency illumination for not less than 90 minutes.
  2. Charger: Fully automatic, solid-state type with sealed transfer relay.
  3. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

## **2.5 MATERIALS**

- A. Metal Parts:
  1. Free of burrs and sharp corners and edges.
  2. Sheet metal components shall be steel unless otherwise indicated.
  3. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit re-lamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during re-lamping and when secured in operating position.

## **2.6 METAL FINISHES**

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

## **2.7 LUMINAIRE SUPPORT**

- A. Comply with requirements in Section "Basic Materials and Methods" for channel and angle iron supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as luminaire.
- D. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gauge.
- E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gauge.
- F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- G. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.
- H. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 INSTALLATION**

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports:
  - 1. Sized and rated for luminaire weight.
  - 2. Able to maintain luminaire position after cleaning and relamping.
  - 3. Provide support for luminaire without causing deflection of ceiling or wall.
  - 4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.
- E. Flush-Mounted Luminaire Support:
  - 1. Secured to outlet box.
  - 2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
  - 3. Trim ring flush with finished surface.
- F. Wall-Mounted Luminaire Support:
  - 1. Attached to structural members in walls or a minimum 20 gauge backing plate attached to structure.
- G. Suspended Luminaire Support:
  - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
  - 2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
  - 3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing for suspension for each unit length of luminaire chassis, including one at each end.
  - 4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- H. Ceiling-Grid-Mounted Luminaires:
  - 1. Fixture is to be supported at two (2) opposite ends to the steel frame of the building using the same type of wire as used to support the lay-in ceiling track.
  - 2. Support Clips:
    - a. Fasten fixtures to ceiling grid main runner members at or near four (4) fixture corners with sheet metal screws.
  - 3. Fixtures of Sizes Less Than Ceiling Grid Pattern:
    - a. Install as indicated on reflected ceiling plans or center in acoustical panel.
    - b. Support fixtures independently with at least two 3/4-inch (metal channels spanning and secured to ceiling tees.
    - c. Fixture is to be supported at two (2) opposite ends to the steel frame of the building using the same type of wire as used to support the lay-in ceiling track.
  - 4. Luminaire support wires shall be color coded and tagged to be distinguishable from the grid support wires.

**3.3 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:
  - 1. Operational Test: After installing luminaires, switches, and accessories; and after electrical circuitry has been energized, test units to confirm proper operation.
  - 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify normal transfer to battery power source and retransfer to normal. Perform a test on each unit after it is permanently installed and charged for a minimum of 24 hours. Battery shall be tested for 90 minutes. The battery test shall demonstrate compliance with the requirements of NEC 700.12(I). Repair and/or replace any units that fail the test, then retest. The battery test shall be performed 10 days prior to the final test by the State Construction Office. Provide a copy of test reports to the State Construction Office.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Corroded Fixtures: During warranty period, replace fixtures that show any signs of corrosion.

**END OF SECTION**

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**SECTION 27 1100  
COMMUNICATIONS EQUIPMENT ROOM FITTINGS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. *STS-1000 Telecommunications Wiring Guidelines* for the State of North Carolina, State Telecommunications Services.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Telecommunications mounting elements.
  - 2. Backboards.
  - 3. Telecommunications equipment racks and cabinets.
  - 4. Telecommunications service entrance pathways.
  - 5. Grounding.
- B. Related Sections:
  - 1. Section "Communications Horizontal Cabling".
- C. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.
- D. BICSI: Building Industry Consulting Service International.
- E. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
- F. LAN: Local area network.
- G. RCDD: Registered Communications Distribution Designer.

**1.3 PERFORMANCE REQUIREMENTS**

- A. Seismic Performance: Floor-mounted cabinets and cable pathways shall withstand the effects of earthquake motions determined according to ASCE 7.
  - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

**1.4 SUBMITTALS**

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
- C. Qualification Data: For installer, qualified layout technician, installation supervisor, and field inspector.

**1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: Cabling Installer shall have personnel certified by BICSI on staff.
  - 1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of RCDD.

2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.

B. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.

C. Grounding: Comply with ANSI-J-STD-607-A.

## **1.6 PROJECT CONDITIONS**

- A. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and work above ceilings is complete.

## **1.7 COORDINATION**

- A. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.

1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
2. Record agreements reached in meetings and distribute them to other participants.
3. Adjust arrangements and locations of equipment frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
4. Adjust arrangements and locations of equipment with equipment frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.

- B. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

## **PART 2 - PRODUCTS**

### **2.1 PATHWAYS**

- A. General Requirements: Comply with TIA/EIA-569-A.

- B. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable tie slots fasten cable ties to brackets.

1. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.
2. Support brackets with cable tie slots for fastening cable ties to brackets.
3. Lacing bars, spools, J-hooks, and D-rings.
4. Straps and other devices.

- C. Cable Trays:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Cable Management Solutions, Inc.
  - b. Cablofil Inc.
  - c. Cooper B-Line, Inc.
  - d. Cope - Tyco/Allied Tube & Conduit.
  - e. GS Metals Corp.
2. Cable Tray Materials: Metal, suitable for indoors and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inch thick or hot-dip galvanizing, complying with ASTM A 123/A 123M, Grade 0.55, not less than 0.002165 inch thick.

- a. Basket Cable Trays: Dimensions as indicated on the drawings, and 4" deep. Wire mesh spacing shall not exceed 2 by 4 inches.
  - b. Ladder Cable Trays: Nominal dimensions as indicated on the drawings, and a rung spacing of 9 inches.
- D. Conduit and Boxes: Comply with requirements in Section "Raceway and Boxes".
- 1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep. Refer to drawing legends where larger boxes may be intended.

## **2.2 BACKBOARDS**

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches.

## **2.3 EQUIPMENT FRAMES**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- 1. ADC.
  - 2. Aim Electronics; a brand of Emerson Electric Co.
  - 3. AMP; a Tyco International Ltd. company.
  - 4. Cooper B-Line, Inc.
  - 5. Hubbell Premise Wiring.
  - 6. KRONE Incorporated.
  - 7. Leviton Voice & Data Division.
  - 8. Middle Atlantic Products, Inc.
  - 9. Nordex/CDT; a subsidiary of Cable Design Technologies.
  - 10. Ortronics, Inc.
  - 11. Panduit Corp.
  - 12. Siemon Co. (The).
- B. General Frame Requirements:
- 1. Equipment Frames: Freestanding and wall-mounting, modular units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
  - 2. Module Dimension: Width compatible with EIA 310 standard, 19-inch panel mounting.
  - 3. Finish: Manufacturer's standard, baked-polyester powder coat.
- C. Floor-Mounted Racks: Modular-type, steel or aluminum construction.
- 1. Baked-polyester powder coat finish.
  - 2. Vertical and horizontal cable management channels.
  - 3. Top and bottom cable troughs.
  - 4. Grounding lug.
  - 5. Power strip.
- D. Cable Management for Equipment Frames:
- 1. Metal, with integral wire retaining fingers.
  - 2. Baked-polyester powder coat finish.
  - 3. Vertical cable management panels shall have front and rear channels, with covers.
  - 4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

## **2.4 POWER STRIPS**

- A. Power Strips: Comply with UL 1363.
- 1. Rack mounting.
  - 2. Six, 20-A, 120-V ac, NEMA WD 6, Configuration 5-20R receptacles.
  - 3. LED indicator lights for power and protection status.
  - 4. LED indicator lights for reverse polarity and open outlet ground.
  - 5. Circuit Breaker and Thermal Fusing: Unit continues to supply power if protection is lost.
  - 6. Cord connected with 10-foot line cord.

7. Rocker-type on-off switch, illuminated when in on position.
8. Peak Single-Impulse Surge Current Rating: 26 kA per phase.
  - a. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all 3 modes shall be not more than 330 V.

## **2.5 GROUNDING**

- A. Comply with requirements in Section "Grounding and Bonding" for grounding conductors and connectors.
- B. Telecommunications Main Bus Bar:
  1. Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
  2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide with 9/32-inch holes spaced 1-1/8 inches apart.
  3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.
- C. Comply with ANSI-J-STD-607-A.

## **2.6 LABELING**

- A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

# **PART 3 - EXECUTION**

## **3.1 ENTRANCE FACILITIES**

- A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.
- B. Install underground pathways complying with recommendations in TIA/EIA-569-A, "Entrance Facilities" Article.
- C. Install underground entrance pathway complying with Section "Raceway and Boxes".

## **3.2 INSTALLATION**

- A. Comply with NECA 1.
- B. Comply with BICSI TDMM for layout and installation of communications equipment rooms.
- C. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.
- D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- E. Paint plywood backboards white unless noted otherwise. For fire-resistant plywood, leave one manufacturer's label at the bottom unpainted and visible.

## **3.3 FIRESTOPPING**

- A. Comply with requirements in Section "Penetration Firestopping."
- B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

## **3.4 GROUNDING**

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI-J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.



- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.
  - 1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

**3.5 IDENTIFICATION**

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements in Section "Electrical Identification".
- B. See Section "Communications Horizontal Cabling" for additional identification requirements. See Evaluations for discussion of TIA/EIA standard as it applies to this Section.
- C. Labels shall be preprinted or computer-printed type.

**END OF SECTION**

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**SECTION 27 1500  
COMMUNICATIONS HORIZONTAL CABLING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. *STS-1000 Telecommunications Wiring Guidelines* for the State of North Carolina, State Telecommunications Services.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Pathways.
  - 2. UTP cabling.
  - 3. Multiuser telecommunications outlet assemblies.
  - 4. Cable connecting hardware and patch panels.
  - 5. Telecommunications outlet/connectors.
  - 6. Cabling system identification products.
  - 7. Cable management system.
- B. Related Sections:
  - 1. Section "Communications Backbone Cabling" for voice and data cabling associated with system panels and devices.

**1.3 DEFINITIONS**

- A. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.
- B. BICSI: Building Industry Consulting Service International.
- C. EMI: Electromagnetic interference.
- D. IDC: Insulation displacement connector.
- E. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).
- F. LAN: Local area network.
- G. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.
- H. RCDD: Registered Communications Distribution Designer.
- I. UTP: Unshielded twisted pair.

**1.4 HORIZONTAL CABLING DESCRIPTION**

- A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the patch panel located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.
  - 1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
  - 2. Bridged taps and splices shall not be installed in the horizontal cabling.
- B. The maximum allowable horizontal cable length is 295 feet (90 m). This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) to the workstation equipment. The maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) in the horizontal cross-connect.

**1.5 PERFORMANCE REQUIREMENTS**

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

## **1.6 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
  - 1. System Labeling Schedules: Electronic copy of labeling schedules.
  - 2. Cabling administration drawings and printouts.
  - 3. Patch panels. Detail mounting assemblies and show elevations and physical relationship between the installed components.
- C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.
- D. Field quality-control reports.
- E. Maintenance Data: For splices and connectors to include in maintenance manuals.

## **1.7 QUALITY ASSURANCE**

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
  - 1. Layout Responsibility: Preparation of Shop Drawings, Cabling Administration Drawings, and field testing program development by an RCDD.
  - 2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- D. Grounding: Comply with ANSI-J-STD-607-A.

## **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Test cables upon receipt at Project site.
  - 1. Test each pair of UTP cable for open and short circuits.

## **1.9 PROJECT CONDITIONS**

- A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

## **1.10 COORDINATION**

- A. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.
- B. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

## **1.11 EXTRA MATERIALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Patch-Panel Units: One of each type.

## **PART 2 - PRODUCTS**

### **2.1 PATHWAYS**

- A. General Requirements: Comply with TIA/EIA-569-A.
- B. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
  - 1. Support brackets with cable tie slots for fastening cable ties to brackets.
  - 2. Lacing bars, spools, J-hooks, and D-rings.
  - 3. Straps and other devices.

C. Cable Trays:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Cable Management Solutions, Inc.
  - b. Cablofil Inc.
  - c. Cooper B-Line, Inc.
  - d. Cope - Tyco/Allied Tube & Conduit.
  - e. GS Metals Corp.
2. Cable Tray Materials: Metal, suitable for indoors, and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inch (0.012 mm) thick or hot-dip galvanizing, complying with ASTM A 123/A 123M, Grade 0.55, not less than 0.002165 inch (0.055 mm) thick.
  - a. Basket Cable Trays: Dimensions as indicated on the drawings, and 4" deep. Wire mesh spacing shall not exceed 2 by 4 inches (50 by 100 mm).
  - b. Ladder Cable Trays: Nominal dimensions as indicated on the drawings, and a rung spacing of 9 inches (305 mm).

D. Conduit and Boxes: Comply with requirements in Section "Raceway and Boxes."

1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

**2.2 BACKBOARDS**

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm).

**2.3 UTP CABLE**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Belden CDT Inc.; Electronics Division.
2. Berk-Tek; a Nexans company.
3. CommScope, Inc.
4. Draka USA.
5. Genesis Cable Products; Honeywell International, Inc.
6. KRONE Incorporated.
7. Mohawk; a division of Belden CDT.
8. Molex Premise Networks; a division of Molex, Inc.
9. Nordex/CDT; a subsidiary of Cable Design Technologies.
10. Superior Essex Inc.
11. SYSTIMAX Solutions; a CommScope, Inc. brand.
12. 3M.
13. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

- B. Description: 100-ohm, 4-pair UTP, covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 6.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
  - a. Communications, General Purpose: Type CM or CMG.
  - b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
  - c. Communications, Riser Rated: Type CMR, complying with UL 1666.
  - d. Communications, Limited Purpose: Type CMX.
  - e. Multipurpose: Type MP or MPG.
  - f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
  - g. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

## 2.4 UTP CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. American Technology Systems Industries, Inc.
  - 2. Dynacom Corporation.
  - 3. Hubbell Premise Wiring.
  - 4. KRONE Incorporated.
  - 5. Leviton Voice & Data Division.
  - 6. Molex Premise Networks; a division of Molex, Inc.
  - 7. Nordex/CDT; a subsidiary of Cable Design Technologies.
  - 8. Panduit Corp.
  - 9. Siemon Co. (The).
  - 10. Tyco Electronics/AMP Netconnect; Tyco International Ltd.
- B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
- C. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
  - 1. Number of Jacks per Field: One for each four-pair conductor group of cables, plus spares and blank positions adequate to suit specified expansion criteria.
- D. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
- E. Patch Cords: Factory-made, four-pair cables in 48-inch (1200-mm) lengths; terminated with eight-position modular plug at each end.
  - 1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.

## 2.5 TELECOMMUNICATIONS OUTLET/CONNECTORS

- A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-B.1.
- B. Workstation Outlets:
  - 1. Two-port-connector assemblies mounted in single faceplate.
  - 2. Four-port-connector assemblies mounted in multigang faceplate.
  - 3. See drawings for other outlet quantities for number of ports. Mount assemblies in multigang faceplate.
  - 4. Metal Faceplate: Stainless steel, complying with requirements in Section "Wiring Devices."
  - 5. For use with snap-in jacks accommodating any combination of UTPwork area cords.
    - a. Flush mounting jacks.
  - 6. Legend: Snap-in, clear-label covers and machine-printed paper inserts.

## 2.6 GROUNDING

- A. Comply with requirements in Section "Grounding and Bonding" for grounding conductors and connectors.
- B. Comply with ANSI-J-STD-607-A.

## 2.7 IDENTIFICATION PRODUCTS

- A. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- B. Comply with requirements in Section "Electrical Identification."

## **2.8 SOURCE QUALITY CONTROL**

- A. Factory test UTP cables on reels according to TIA/EIA-568-B.1.
- B. Factory test UTP cables according to TIA/EIA-568-B.2.
- C. Cable will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

## **PART 3 - EXECUTION**

### **3.1 WIRING METHODS**

- A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters . Conceal raceway except in unfinished spaces.
  - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
- B. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

### **3.2 INSTALLATION OF PATHWAYS**

- A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.
- B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Section "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.
- C. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
- D. Comply with requirements in Section "Raceway and Boxes" for installation of conduits and wireways.
- E. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- F. Pathway Installation in Communications Equipment Rooms:
  - 1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
  - 2. Install cable trays to route cables if conduits cannot be located in these positions.
  - 3. Secure conduits to backboard when entering room from overhead.
  - 4. Extend conduits 6 inches (152 mm) above finished floor.
  - 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- G. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

### **3.3 INSTALLATION OF CABLES**

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
  - 1. Comply with TIA/EIA-568-B.1.
  - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
  - 3. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
  - 4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
  - 5. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.

6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
  7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
  8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
  9. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
  10. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.
- C. UTP Cable Installation:
1. Comply with TIA/EIA-568-B.2.
  2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
- D. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
  2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1524 mm) apart.
  3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- E. Group connecting hardware for cables into separate logical fields.
- F. Separation from EMI Sources:
1. Comply with BICSI TDMM and TIA/EIA-569-A for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
  2. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
    - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
    - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
  3. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
  4. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

### 3.4 FIRESTOPPING

- A. Comply with requirements in Section "Firestopping."
- B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

### 3.5 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI-J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar



with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

### 3.6 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Section "Electrical Identification."
- B. Paint plywood backboards white. Comply with requirements in Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- C. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- D. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.
- E. Cable and Wire Identification:
  - 1. Label each cable within 4 inches (100 mm) of each termination, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
  - 2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
  - 3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 30 feet (9 m).
  - 4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
    - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
    - b. Label each unit and field within distribution racks and frames.
  - 5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
- F. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.
  - 1. Cables use flexible vinyl or polyester that flex as cables are bent.

### 3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Visually inspect UTP cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
  - 2. Visually confirm Category 6, marking of outlets, cover plates, outlet/connectors, and patch panels.
  - 3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

4. UTP Performance Tests:
  - a. Test for each outlet and MUTOA. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:
    - 1) Wire map.
    - 2) Length (physical vs. electrical, and length requirements).
    - 3) Insertion loss.
    - 4) Near-end crosstalk (NEXT) loss.
    - 5) Power sum near-end crosstalk (PSNEXT) loss.
    - 6) Equal-level far-end crosstalk (ELFEXT).
    - 7) Power sum equal-level far-end crosstalk (PSELFEXT).
    - 8) Return loss.
    - 9) Propagation delay.
    - 10) Delay skew.
  - C. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
  - D. End-to-end cabling will be considered defective if it does not pass tests and inspections.
  - E. Prepare test and inspection reports.

### **3.8 DEMONSTRATION**

- A. Train Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets.

**END OF SECTION**

**SECTION 28 3111**  
**DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

**1.2 SYSTEM DESCRIPTION**

- A. Microprocessor controlled, intelligent reporting fire detection and alarm system.

**1.3 SUMMARY**

- A. Section Includes:
  - 1. Fire-alarm control unit / fire alarm panel.
  - 2. Manual fire-alarm boxes.
  - 3. System smoke detectors.
  - 4. Carbon monoxide detectors.
  - 5. Notification appliances.
  - 6. Remote annunciators.
  - 7. Addressable interface device.
  - 8. Power supplies.
  - 9. Digital alarm communicator transmitter.

**1.4 DEFINITIONS**

- AHJ Authority Having Jurisdiction.
- AHU Air Handler Unit.
- IR Infrared.
- LED Light-emitting diode.
- NICET National Institute for Certification in Engineering Technologies.
- NRTL Nationally Recognized Testing Laboratory.

**1.5 PERFORMANCE REQUIREMENTS**

- A. Comply with applicable provisions of the North Carolina State Building Code.
- B. Comply with applicable provisions of NFPA 72, National Fire Alarm Code.
- C. Equipment supplied shall be specifically listed for its intended use and shall be installed in accordance with the manufacturer's instructions.

**1.6 QUALITY ASSURANCE**

- A. Manufacturer's Qualifications:
  - 1. Firms shall be regularly engaged in the manufacture of fire alarm systems of the types, sizes, and electrical characteristics required for this project.
  - 2. The system shall comply with provisions of UL safety standards pertaining to fire detection and alarm systems. Products and components shall be Listed and Labeled.
  - 3. Fire detection and alarm systems and accessories shall be FM approved.
  - 4. Firms shall maintain factory authorized service organization. Firms shall maintain spare parts stock.
- B. Designer for Preparation of Shop Drawings and Calculations Qualifications:
  - 1. Personnel shall be trained and certified by manufacturer for system design required for this Project.
  - 2. Personnel shall be certified by NICET as fire-alarm Level III (minimum) technician.

- C. Installer Qualifications:
  - 1. Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
  - 2. Supervisor of installation shall be certified by NICET as fire-alarm Level II (minimum) technician.
  - 3. Supervisor of installation shall be certified as an authorized representative of the equipment manufacturer.
  - 4. Minimum of 5 years of experience installing fire detection and alarm systems similar in size and scope to this project.
- D. Manufacturer's Field Service Technician Qualifications:
  - 1. Personnel shall be certified by NICET as fire-alarm Level II (minimum) technician.
  - 2. Personnel shall be trained and certified by manufacturer for installation of units specifically required for this Project within the most recent 24 months.
  - 3. If not trained by the manufacturer within 24 months (as noted in 2 above), but within 36 months, NICET fire alarm Level III (minimum) technician certification is required.
- E. Source Limitations for Fire-Alarm System and Components:
  - 1. Obtain fire-alarm system equipment and components from a single source.
  - 2. For facilities with existing functional systems in place, new components shall be compatible and listed for use with, and operate as, an extension of existing system.
- F. Electrical Components, Devices, and Accessories: Listed and labeled by a third party agency that is accredited by the NCBC (North Carolina Building Code Council) to label electrical and mechanical equipment.
- G. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

## 1.7 SUBMITTALS

- A. Qualification Data:
  - 1. Designer:
    - a. Manufacturer training certification.
    - b. NICET certification
  - 2. *Installer:*
    - a. Manufacturer training certification.
    - b. NICET certification.
    - c. Authorized representative of equipment manufacturer certification.
    - d. Experience documentation; 5 years of similar size & scope projects.
  - 3. Manufacturer Field Service Technician:
    - a. Manufacturer training certification.
    - b. NICET certification.
- B. Product Data:
  - 1. Manufacturer data for each type of product, equipment, device, etc. proposed.
  - 2. For devices, include milliamp (mA) draw and listed minimum voltage required to operate for each type of device.
  - 3. For panels and power supplies, include voltage drop allowed for the panel and power supplies.
  - 4. For panels and power supplies, include voltage drop for individual Notification Appliance Circuits (NAC).
- C. Shop Drawings: For fire-alarm system to demonstrate compliance with project drawings and specifications. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
  - 2. Provide floor plans with:
    - a. Final equipment and device locations, including address of each addressable device and notification appliance.

- b. Wiring diagrams with proposed conduit routing and conductors/cables in each conduit section.
    - c. Distances for NAC circuitry sections.
  - 3. Provide riser diagrams showing consecutive connections of all devices. Include device addresses. Include candela ratings for strobes.
  - 4. Battery calculations and voltage drop calculations shall be placed on dedicated drawing sheets.
  - 5. Provide voltage drop calculations for notification appliance circuits. Voltage drop at EOL device shall not exceed 14% of the battery voltage. Worst case voltage at each notification appliance shall be no less than the minimum listed operating voltage.
  - 6. Provide battery calculations.
  - 7. System Response Matrix: Indicate fire alarm system's actions (outputs) required for each type of alarm, supervisory, and trouble signal.
  - 8. Duct Detectors: Provide performance parameters and installation details for detectors, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
  - 9. Graphic Annunciator layout.
- D. Installation Instructions: Manufacturer's detailed installation instructions for Fire Alarm Control Unit, duct mounted smoke detectors, flow switches, tamper switches, supervisory switches, and similar items which require mechanical installation.
- E. Sample Warranty Statement.
- F. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section "Operation and Maintenance Data," include the following:
  - 1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
  - 2. Provide "System Record of Completion" document with "Completion Documents" Article in "Documentation" chapter in NFPA 72.
  - 3. System Status and Programming Report.
  - 4. Record copy of site-specific software on USB flash drive (thumb drive).
  - 5. As-built documents.
    - a. Provide duplicates of the shop drawing plans, wiring diagrams, and riser diagrams showing comprehensive and clear field revisions. Include loop numbers, device addresses, terminal numbers where connected to equipment, and wire color codes.
    - b. Provide a drawing with submitted battery and voltage drop calculations. Include a field for entering actual metered values during system testing.
  - 6. Technical literature for all control equipment, devices, isolation modules, relays, power supplies, alarm/supervisory signal initiating devices, etc. Include maintenance data and parts lists. Include circuit diagrams of all control panels, modules, annunciators, communications panels, etc.
  - 7. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
    - a. Frequency of testing of installed components.
    - b. Frequency of inspection of installed components.
    - c. Requirements and recommendations related to results of maintenance.
    - d. Manufacturer's user training manuals.
  - 8. Manufacturer's required maintenance related to system warranty requirements.
  - 9. Abbreviated operating instructions, framed and mounted at fire-alarm control unit.
  - 10. Copy of NFPA 25.

## **1.8 SOFTWARE SERVICE AGREEMENT**

- A. Comply with UL 864.

- B. Technical Support: Beginning with Final Acceptance, provide software support for one year.
- C. Upgrade Service:
  - 1. Update software to latest version at Project completion.
  - 2. The manufacturer and authorized distributor of the system installed shall maintain software records on the system installed.
  - 3. At no charge, install and program software upgrades that become available within one year from date of Final Acceptance and for the life of the warranty period. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
  - 4. For new software versions that correct operating problems or bugs, free upgrades shall be provided during the life of the system.
  - 5. Provide 30 days notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

## **1.9 EXTRA MATERIALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Manual Fire Alarm Boxes: 2% of installed quantity, but no fewer than 1 unit of each type.
  - 2. Addressable Control Relays: 4% of installed quantity, but no fewer than 1 unit of each type.
  - 3. Indoors Horn/Strobes: 4% of installed quantity, but no fewer than 1 unit of each type.
  - 4. Indoor Strobes: 4% of installed quantity, but no fewer than 1 unit of each type.
  - 5. Monitor Modules (Addressable Interface): 4% of installed quantity, but no fewer than 1 unit of each type.
  - 6. Isolation Modules: 4% of installed quantity, but no fewer than 1 unit of each type.
  - 7. Smoke Detectors, Fire Detectors: 6% of installed quantity, but no fewer than 1 unit of each type.
  - 8. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but no fewer than 1 unit of each type.
  - 9. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
  - 10. Keys and Tools: One extra set for access to locked and tamper-proofed components.
  - 11. Fuses: Two of each type and rating installed in the system.
  - 12. Interconnection cable, where required, for connecting the FACU to a personal computer.

## **1.10 WARRANTY**

- A. Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail because of defects in materials or workmanship within one year from the date of final inspection and acceptance by the Owner.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Fire Lite Alarms.
  - 2. Edwards.
  - 3. Mircom.
  - 4. Notifier.
  - 5. Siemens Building Technologies, Inc.; Fire Safety Division.
  - 6. Silent Knight.

### **2.2 SYSTEMS OPERATIONAL DESCRIPTION**

- A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:
  - 1. Manual stations.

2. Smoke detectors.
  3. Automatic sprinkler system water flow.
- B. Fire-alarm signal shall initiate the following actions:
1. Record events in the system memory.
  2. Continuously operate alarm notification appliances until initiating device and control unit have been reset.
  3. Identify alarm at fire-alarm control unit and remote annunciators with flashing LED, audible piezo-electric signal, and LCD display of alarm point and location.
  4. Transmit alarm signal to the remote alarm receiving station.
  5. Unlock electric door locks in designated egress paths.
  6. Release fire and smoke doors held open by magnetic door holders.
  7. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode. Typically, shutdown of all HVAC equipment will be initiated.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
1. Fire alarm control unit has lost communication with network.
  2. Emergency Responder Radio Communications System monitored points.
  3. Valve supervisory switch.
  4. Duct smoke detectors.
  5. Carbon monoxide detectors.
- D. System trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
  2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
  3. Loss of communication with addressable sensor, input module, relay, control module, remote annunciator.
  4. Ground or a single break in fire-alarm control unit internal circuits.
  5. Break in standby battery circuitry.
  6. Failure of battery charging.
  7. Abnormal position of any switch at fire-alarm control unit or annunciator.
  8. Loss of primary power or abnormal ac voltage at fire-alarm control unit.
  9. HVAC bypass defeat switch in bypass position.
- E. System Trouble and Supervisory Signal Actions:
1. Identify specific device initiating event at fire-alarm control unit and remote annunciators.
  2. Provide adjustable time delay capability of 0 to 60 minutes to delay transmission of the trouble and supervisory signals. The delay for loss of primary power or abnormal ac voltage shall be 1 to 3 hours.

## **2.3 FIRE-ALARM CONTROL UNIT**

- A. General Requirements for Fire-Alarm Control Unit (FACU):
1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.
    - a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
    - b. Include a real-time clock for time annotation of events on the event recorder. Time of day and date shall be retained upon loss of system primary and secondary power.
    - c. The system shall have multiple access levels for Owner authorized personnel to disable individual alarm inputs or normal system responses for alarms, without changing the system's programming.
    - d. Programming and editing of the existing program shall be possible without special equipment and without interrupting alarm monitoring functions.

2. Enclosure:
    - a. 3rd party listed cabinet suitable for surface, flush, or semi-flush mounting.
    - b. Finish: Rust resistant primer and manufacturer standard finish.
    - c. Door hinged on either right or left side (field selectable).
    - d. Door with key lock and glass opening for viewing all indicators.
    - e. Manufacturer's trim kit for flush or semi-flush mounting.
  3. Addressable initiation devices that communicate device identity and status (normal, trouble, and alarm conditions).
    - a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire-alarm control unit.
    - b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
    - c. Alarm Verification: The system shall provide, as a feature, an alternate signal processing algorithm to verify the presence of smoke. The algorithm shall be selectable when programming. The total effective delay created by the algorithm shall not exceed 60 seconds.
  4. Addressable control circuits for shutdown of mechanical equipment.
  5. Signaling Line Circuits (SLC) Interface Boards:
    - a. Integral microprocessor with capability of operating locally in the event of FACU main microprocessor.
    - b. Provides power and communication with devices on SLC circuit loop.
    - c. Provide or be capable of expansion to 198 intelligent/addressable devices minimum per circuit, 1980 total initiating points minimum, and 20% spare capacity.
    - d. Receives and processes analog information from all detectors with software to automatically maintain detectors' desired sensitivity levels
    - e. Automatic detector testing and determination of detector maintenance requirements.
  6. The system shall retain historical data and device parameters including device sensitivity measurement testing results. The system shall have the capability to display and print device data, parameters, and sensitivity test results. Trouble indication shall be initiated when any smoke detector approaches 80% of its alarm threshold due to gradual contamination.
- B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
1. Annunciator and Display: Liquid-crystal type, backlit, 80 characters, minimum.
  2. Individual, color-coded system status LEDs for AC POWER, SYSTEM ALARM, SYSTEM TROUBLE, and SIGNAL SILENCE.
  3. Keypad: Alphanumeric; arranged to permit entry and execution of field programming, display, and control commands.
  4. Operator interface functions:
    - a. Acknowledge Switch.
    - b. Alarm Silence Switch with a Subsequent Alarm resound feature.
    - c. System Reset Switch.
    - d. System Test Switch.
    - e. Lamp Test Switch.
- C. Circuits:
1. Notification Appliance Circuits (NAC):
    - a. NFPA 72 Class B.
    - b. End of line (EOL) resistors shall be installed for FACU supervision of circuit integrity. Locate EOL resistors as follows:
      - 1) Where accessible to fire alarm system maintenance personnel.



- 2) Where maintenance or testing at the EOL resistor location will not be disruptive to the normal use of the facility.
    - 3) Where not easily accessible to the normal building occupants.
    - 4) Where no higher than 9' AFF or lower than 7' AFF.
    - 5) Not in stairwells or restrooms.
  - c. NAC circuits shall not exceed 75% of maximum load current allowed.
2. Signaling Line Circuits (SLC): NFPA 72 Class A, no "T" taps.
3. Initiating Device Circuits (IDC): NFPA 72 Class B.
4. Digital electronic signals shall utilize check digits or multiple polling to prevent a single ground or open on any SLC from causing system malfunction, loss of operating power, or the ability to report an alarm.
5. Isolation Modules:
  - a. Isolation modules shall automatically isolate wire-to-wire shorts on an SLC circuit.
  - b. Install isolation modules at the following locations:
    - 1) In or adjacent to the FACU at each end of addressable loops.
    - 2) After each 20 initiating devices and control points on an addressable loop.
    - 3) For addressable loops with less than 20 devices and control points, install isolators at the middle of the loop in addition to those at the FACU.
    - 4) At the point where an addressable loop extends outside of the building.
    - 5) In terminal cabinets on each floor where addressable loops cover more than one floor level.
  - c. Isolation modules shall be readily accessible, not located above ceilings, and clearly labeled. Record drawings shall indicate isolator module locations.
  - d. Provide an LED that flashes to indicate the isolation module is operational and that burns steady to indicate that a short circuit condition has been detected and isolated.
6. Serial Interfaces: One RS-232 ports for printers.
7. Wiring Methods:
  - a. All fire alarm circuitry shall be in  $\frac{3}{4}$ " minimum metal conduit. Use surface metal raceway where exposed. Junction boxes and covers not in finished areas shall be painted red. PVC conduit may be used underground, in concrete, or in locations subject to severe corrosion.
  - b. SLC addressable loop circuits shall be wired with type FPL/FLLR/FPLP fire alarm cable, 18 AWG minimum, low capacitance, copper, twisted pair. Cable jacket shall have a red jacket with red and black conductor insulation. For underground circuits, use type TC or PLTC cable (PE insulated).
  - c. All other circuits shall be wired with 14 AWG minimum, stranded copper, type THHN/THWN conductors. Color codes follow:
    - 1) Initiating Circuits, General: Red(+) / White(-).
    - 2) Initiating Circuits, Smoke Only: Violet(+) / Gray(-).
    - 3) Notification Appliance / alarm initiating circuits: Blue(+) / Black(-).
    - 4) AHU Shutdown Circuits: Yellow(+) / Brown(-).
    - 5) Door Control Circuits (magnet power): Orange(+) / Orange(-).
    - 6) Elevator Capture Circuits: Brown.
    - 7) Separate 24 VDC operating power (for equipment): Yellow(+) / Brown(-).
    - 8) Circuits from zone adapter modules (ZAMs) to monitored devices: Violet(+) / Gray(-).
  - d. Conduits that penetrate exterior walls shall be sealed with non-hardening electrical putty to prevent condensation infiltration.
  - e. Splices are allowed only at device terminals or on terminal blocks in cabinets.
  - f. For multistory buildings, circuits shall be routed through terminal cabinets at each floor. Cabinets shall be hinged cover enclosures with terminal blocks for circuitry connections. Cabinets shall typically be accessible at floor level. If the building

layout prevents installation for floor level access; with approval of the Owner and Engineer, a terminal cabinet may be located above a suspended ceiling. Its location shall be clearly and permanently identified with a placard legible from the floor.

- g. Terminal block screws shall have pressure wire connectors of the self-lifting or box lug type.
  - h. Permanent wire markers shall be used to label connections at the FACU, other control equipment, power supplies, and in terminal cabinets.
  - i. Branch circuit breakers supplying 120 VAC to system equipment shall be physically protected with a breaker handle lock and identified with a 1/4" permanent red dot applied to the breaker handle or exposed body area. The red identification shall not damage the overcurrent protective devices or obscure the manufacturer's markings.
- D. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory.
- E. AHU Shutdown Defeat Toggle Switch: A supervised toggle switch shall be provided in/adjacent to the Fire Alarm Control Unit, or as a key operated function in a Remote Annunciator. If installed at the Remote Annunciator, provide an engraved label at the FACU with AHU Shutdown Defeat Switch location. When placed in the Shutdown Defeat position, a system "trouble" signal shall be initiated.
- F. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
- G. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.
- 1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
  - 2. 120V power supply entry point to the FACU enclosure shall be where designated by the manufacturer.
  - 3. 120V branch breaker shall be physically protected with a handle lock and identified with a 1/4" diameter permanent red dot applied to the breaker handle or exposed body area.
- H. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
- 1. Batteries:
    - a. Gel-cell, sealed, plate nickel cadmium, maintenance free.
    - b. Minimum of 60 hours standby capacity plus:
      - 1) 5 minutes of horn/strobe full alarm load.
      - 2) 15 minutes of voice evacuation full alarm load.
  - 2. Charger: Dual-rate charging techniques for fast battery recharge.
- I. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

## 2.4 MANUAL FIRE-ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes:
- 1. Comply with UL 38.
  - 2. Single-action mechanism, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
  - 3. Positive, visual indication of operation.

4. Station Test and Reset: Key-operated switch.
5. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
6. Pull Station Cover with Horn: Provide cover for all manual pull stations.
  - a. Clear, tamperproof, polycarbonate cover hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
  - b. Listed for outdoor use for outdoor pull stations.
  - c. Flush mount cover for recessed boxes. Surface mount cover with conduit spacer for applications requiring surface mounted conduit.

## 2.5 SMOKE DETECTORS

- A. General Requirements for System Smoke Detectors:
  1. Comply with UL 268; operating at 24-V dc, nominal.
  2. Detectors shall typically be two-wire type for connection to an SLC. Four-wire type detectors may be required if connecting to an existing four-wire system.
  3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
  4. Integral Visual-Indicating Lights: Provide both alarm and power LEDs, flashing under normal conditions. LEDs shall burn steady, controlled by the FACU, to indicate an alarm condition.
  5. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring. Provide terminals in the fixed base for connection of a remote alarm LED.
  6. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
  7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
  8. Test Means: Provide a means to simulate an alarm condition and report to the FACU. Test shall be initiated at the detector (activation of a magnetic switch) or initiated remotely on command from the FACU when in "test" condition.
- B. Photoelectric Smoke Detectors:
  1. Use photoelectric / light scattering principal to measure smoke density and send data to the FACU representing analog level of smoke density.
  2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
    - a. Primary status.
    - b. Device type.
    - c. Present average value.
    - d. Present sensitivity selected.
    - e. Sensor range (normal, dirty, etc.).
- C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.
  1. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
    - a. Primary status.
    - b. Device type.
    - c. Present average value.

- d. Present sensitivity selected.
- e. Sensor range (normal, dirty, etc.).
- 2. Each sensor shall have multiple levels of detection sensitivity.
- 3. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied. Extend the full width of the duct and provide end support for those over 36" long.
- 4. Provide a Remote Alarm Indicating Light (RAIL) with test switch for each duct detector, installed in the nearest corridor or public area.
- 5. Provide a hinged duct access panel, 12"x12" minimum, for sampling tube inspection and cleaning.
- 6. Weatherproof Duct Housing Enclosure: Where installed outside or in damp or wet locations, provide NEMA 250, Type 4X; NRTL listed for use with the supplied detector.

## **2.6 NOTIFICATION APPLIANCES**

- A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, equipped for mounting as indicated and with screw terminals for system connections.
  - 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections. Comply with requirements for both visual and audible notification appliances.
- B. Visible Notification Appliances (Strobes):
  - 1. Xenon strobe lights complying with UL 1971, 24-V dc nominal.
  - 2. Rated Light Output: 15/30/75/110 cd, selectable in the field.
  - 3. Flashing shall be in a temporal pattern, synchronized with other units. Maximum pulse duration: 0.2 seconds.
  - 4. Clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" shall be engraved in minimum 1-inch high letters on the lens.
  - 5. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
  - 6. Strobe Leads: Factory connected to screw terminals.
  - 7. Mounting Faceplate: Factory finished, red .
- C. Audible Notification Appliances (Horns / Sounders):
  - 1. Electric-vibrating-polarized type, 24-V dc nominal; with provision for housing the operating mechanism behind a grille.
  - 2. Provide an ANSI S3.41 three-pulse temporal pattern audible signal, synchronized.
  - 3. Horns shall produce a sound-pressure level of 90 dB, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol. Output sound level shall be 120 dB maximum.
  - 4. Devices located in sleeping areas shall produce a low frequency alarm signal with a waveform fundamental frequency of 520 Hz.
  - 5. Devices located outdoors shall be listed for use in wet locations.
  - 6. Field programmable without the use of special tools.
- D. Bells: 10" diameter vibrating type, 24V dc nominal. Bells located outdoors shall be listed for use in wet locations.

## **2.7 ADDRESSABLE INTERFACE DEVICES**

- A. Monitor Modules:
  - 1. For use in providing a system address for alarm-initiating devices for wired applications with normally open dry contacts.
  - 2. Provide an LED that flashes under normal conditions, indicating that the monitor module is operational and in regular communication with the FACU.

3. Modules installed in non-conditioned spaces shall be tested, listed, and marked for continuous duty across the range of temperatures and humidity expected at their installed locations.
- B. Control Modules:
  1. For use in auxiliary control functions, operating as a dry contact relay.
  2. Typical equipment control functions would include direct signals to: an elevator controller to initiate elevator recall, to a circuit-breaker shunt trip for power shutdown, or to a lighting control system for lighting control scenario under fire alarm conditions.
  3. For use in supervising and controlling the operation of one NAC.
  4. Provide an LED that flashes under normal conditions, indicating that the monitor module is operational and in regular communication with the FACU.

## **2.8 REMOTE ANNUNCIATOR / INDICATOR LIGHTS (RAIL)**

- A. Provide 24V dc RAILS with an associated key-type switch for testing of the annunciated device.

## **2.9 AUXILIARY POWER SUPPLIES**

- A. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module.
  1. Alarm current draw of entire supplied circuitry loads shall not exceed 80 percent of the power-supply module rating.
  2. 120V branch breaker shall be physically protected with a handle lock and identified with a ¼" diameter permanent red dot applied to the breaker handle or exposed body area.
- B. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
  1. Batteries:
    - a. Gel-cell, sealed, plate nickel cadmium, maintenance free.
    - b. Minimum of 60 hours standby capacity plus:
      - 1) 5 minutes of horn/strobe full alarm load.
    - c. Add battery capacity for a 25% safety factor.
  2. Charger: Dual-rate charging techniques for fast battery recharge.
  3. Battery cabinet enclosures shall be twice the size of the batteries contained.
- C. Auxiliary power supplies shall be individually monitored by the FACU and protected by a smoke detector.
- D. Coordinate installation location with the Owner and Engineer. Do not install above ceilings or in non-conditioned spaces.

## **2.10 ALARM COMMUNICATOR TRANSMITTER**

- A. Dual path alarm communicator transmitter shall be compatible with and acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL. Coordinate dialer type and requirements with the owner's standards.
- B. Functional Performance:
  1. Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically transmit signals to a remote supervising station.
  2. If communications is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote supervising station over the alternate communications path.
  3. Transmitter shall automatically report communications to the remote supervising station. If service is lost on communications paths, transmitter shall initiate the local trouble signal.
  4. Precedence of signals transmitted to the remote supervising station shall be: (1) Fire Alarm, (2) Supervisory Signal, (3) Trouble Signal, (4) Security Alarm.
- C. Digital data transmission shall include the following:
  1. Address of the alarm-initiating device.
  2. Address of the supervisory signal.

3. Address of the trouble-initiating device.
  4. Loss of ac supply or loss of power.
  5. Low battery.
  6. Abnormal test signal.
  7. Communication bus failure.
- D. Secondary Power: Integral rechargeable battery and automatic charger.
- E. Self-Test: Conducted automatically every 24 hours with report transmitted to remote supervising station.

## **2.11 SURGE PROTECTION**

- A. AC Input:
1. Mount in listed enclosure adjacent to branch circuit panelboard. Wind small coil (5 to 10 turns) in branch circuit conductor just downstream of the suppressor connection.
  2. Install feed through branch circuit transient suppressor (Ditek #DTK-120SRD, Leviton #51020-WM/DIN, or approved equivalent that is UL 1449 2nd Edition Listed).
- B. DC Circuits Extending Outside Building:
1. Mount inside the building, near the point of entry to or exit from each building in a labeled enclosure.
  2. Provide "pi"-type filter on each conductor, consisting of primary arrestor, series impedance, and fast-acting secondary arrestor that clamps at 30-40V.
  3. A minimum of 36" of conductor length shall be provided between the "pi"-type filter and the first system device in the building.
  4. Acceptable models: Citel America #B280-24VD3, Ditek #DTK-2MHLP24BWB, Simplex #2081-9027/9028.

## **2.12 WATER FLOW SWITCHES**

- A. Flow switches shall be integral, mechanical, non-coded, non-accumulative retard type.
- B. Flow switches shall have an alarm transmission delay that is adjustable from 0 to 60 seconds. Initial settings shall be 30 to 45 seconds.
- C. Flow switches shall be located a minimum of one foot from any fitting that changes the direction of flow and a minimum of 3 feet from a valve, as required by NFPA 13.
- D. Flow switches shall be furnished and installed by the Mechanical/Sprinkler Contractor. The Electrical/Fire Alarm Contractor shall make electrical connections.

## **2.13 VALVE SUPERVISORY SWITCHES**

- A. Supervisory switch mechanisms shall be contained in weatherproof housings with  $\frac{3}{4}$ " tapped conduit entrance fittings and hardware for attachment to the valves. Switch housings shall be finished in red, baked enamel paint.
- B. Mount switches to not interfere with normal operation of the valves. Adjust switches to operate within two revolutions toward the closed position of the valve control, or when the stem of the valve has moved no more than one-fifth of the distance from its normal position.

## **2.14 REMOTE ANNUNCIATOR**

- A. Description: Annunciator functions utilizing an alphanumeric display and LED indicating lights shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual control functions shall match those of fire-alarm control unit; including acknowledge, silence, reset, and test for alarm supervisory, and trouble signals.
1. Mounting: Flush cabinet, NEMA 250, Type 1.
  2. Alarm signal with alarm resound feature.
  3. Communication via two-wire EIA-485 interface.
  4. The fire alarm system shall be capable of supporting a minimum of four remote annunciators.

## **2.15 SNAP EDGE FRAMES**

- A. Description: Mountable Front Load Easy Open Snap Frame
  - 1. Outside edges flip open for quick document changes.
  - 2. Non-glare plastic cover.
  - 3. Design Basis: U-Line #S-2132 Series.
  - 4. For use with operator's instructions and device map.

## **PART 3 - EXECUTION**

### **3.1 EQUIPMENT INSTALLATION**

- A. Comply with NFPA 72 for installation of fire-alarm equipment.
- B. Equipment and Device Mounting:
  - 1. Install fire-alarm control unit with tops of cabinets not more than 72 inches above the finished floor.
  - 2. Install equipment and devices securely attached to walls, ceilings, floors, building structure. Hardware and supports shall be suitable for the load supported. Ceiling mounted devices shall not be supported solely by suspended ceilings.
- C. Smoke- Detector Spacing:
  - 1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
  - 2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
  - 3. HVAC: Locate detectors not closer than 3 feet (1 m) from air-supply diffuser or return-air opening.
  - 4. When installed in a room, orient so that the alarm LED is visible from the nearest door to the corridor.
- D. Duct Smoke Detectors:
  - 1. Comply with NFPA 72 and NFPA 90A.
  - 2. Install sampling tubes so they extend the full width of duct, and install detectors and sampling tubes in a manner that provides convenient access for periodic cleaning and calibration. Sampling tubes over 36" long shall be supported at both ends.
  - 3. Each installation shall have a hinged or latched duct access panel (12"x12" minimum) for sampling tube inspection and cleaning. Provide a permanent decal on duct indicating air flow direction.
  - 4. Each duct detector shall have a RAIL installed in the nearest corridor or public area, identified with an engraved label affixed to the wall or ceiling.
  - 5. Proper installation of duct detectors and access doors shall be coordinated between the Electrical Contractor subcontractor, Mechanical Contractor subcontractor, Fire Alarm subcontractor, and approved by the Engineer prior to equipment installation.
- E. Detector Protection:
  - 1. Unless suitably protected from dust, paint, etc.; detectors shall not be installed until final construction clean-up is complete. If contaminated, detectors shall be replaced.
  - 2. Where accidental damage or deliberate abuse is anticipated, provide a protective guard that is listed for use with the detector and is acceptable to the AHJ.
- F. Audible Alarm-Indicating Devices: Unless ceiling mounted, install not less than 6 inches below the ceiling. Install horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
- G. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn; and unless ceiling mounted, install at least 6 inches below the ceiling.
- H. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- I. Annunciator: Install with top of panel not more than 72 inches above the finished floor.
- J. Control Selector Switches:

1. Toggle switches with LED status indicator lights.
2. Hand in "up" position with amber LED. Auto in "center" position with green LED. Off in "down" position with red LED.

### **3.2 CONNECTIONS**

- A. Fire and Life Safety Doors:
  1. Power failure to smoke and fire doors shall cause their mechanisms to default to egress mode with normal mechanical latching.
  2. Smoke or fire doors shall drop the door hold open magnet within 60 seconds of AC power loss, or their load shall be included in standby battery calculations.
  3. Rolling steel fire doors shall automatically reset when returned to their normal / raised position. Program the fire alarm system to limit which initiation devices release these doors; typically, the smoke detector and/or waterflow alarms in adjacent spaces. Label the FACU appropriately with an information placard regarding rolling steel fire door operation.
- B. Make addressable connections with a supervised interface device to the devices and systems indicated on the drawings. Install the interface device less than 3 feet from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
- C. Sprinkler system supervisory circuits for monitoring flow, valve position, air pressure, water temperature, pump status, etc. shall initiate distinct audible and visual indications at the FACU. The audible signal shall either be a 4" diameter bell or a pulsing piezo-electric alarm. Provide an engraved label adjacent to the bell/alarm indicating "SPRINKLER STATUS ABNORMAL". If only sprinkler valve position is supervised, engraved label shall indicate "SPRINKLER VALVE CLOSED".

### **3.3 REMOTE ALARM TRANSMISSION**

- A. The Contractor shall program the alarm communicator transmitter, connect communication lines, coordinate signal transmission with the supervising station, and verify proper signal receipt by the supervising station.

### **3.4 IDENTIFICATION**

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section "Electrical Identification."
- B. Detectors, appliances, and modules shall be labeled with unique numbers that are indicated on as-built drawings and permanently mounted on device bases. Labels shall be legible from floor level. Detectors shall be labeled uniquely and sequentially starting at the FACU with both SLC and device designations. Labels shall be printed black lettering on clear background and attached to the device base.
- C. Junction and pull box covers shall be labeled to indicate the circuits or function of the conductors contained in the boxes. Labels shall be neatly applied with black lettering on clear background.
- D. Conductors shall be labeled with permanent wire markers at connections at the FACU, other control equipment, power supplies, and terminal cabinets.
- E. Install framed basic operating instructions in a location visible from fire-alarm control unit. Optionally, with Owner concurrence, the instructions may be affixed to the inside of the FACU door.
- F. Floor plans of the fire alarm system installation shall be provided at the FACU.
- G. Install a lockable document cabinet adjacent to the FACU. Key shall match the FACU lock. Label Fire Alarm System Record Documents. Store the following:
  1. As-built record drawings with floor plans of the fire alarm system installation.
    - a. Floor plans shall include device locations and addresses. Indicate equipment, module, and EOL locations.



- b. Provide a legend for symbols used.
  - c. A separate page shall be provided for each floor. Laminate individual pages and bind all pages in a book form.
- 2. NFPA 72 Record of Completion documentation.
- 3. Records of system inspections, testing, and maintenance documentation.
- 4. System calculations.
- 5. System operational matrix.
- H. At all equipment with a 120 VAC power source, provide an engraved label indicating panelboard ID, branch circuit number, and panelboard location. At the FACU, provide an additional engraved label inside the FACU.

### **3.5 GROUNDING**

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

### **3.6 FIELD QUALITY CONTROL**

- A. Programming revisions shall be made only by the Installer.
- B. The Installer shall be present for 100% test, Designer's pre-final review, and Owner inspections.
- C. The individual that programmed the system shall be present for the Engineer's and NC State Construction Office final inspection.
- D. Final field tests shall be witnessed by authorities having jurisdiction.
- E. Manufacturer's Field Service: Engage a factory-authorized service technician to make connections to the FACU; to program the system; to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- F. Tests and Inspections:
  - 1. Visual Inspection: Conduct visual inspection prior to testing.
    - a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
    - b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
  - 2. Conductor Testing: All conductors shall be tested for grounds, opens and shorts prior to termination at panels and installation of detector heads. Conductors shall be megger tested for a minimum of 10 megohms from conductor to ground and conductor to conductor. Provide record of test results to Engineer in advance of acceptance inspection.
  - 3. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
  - 4. Test 100% of alarm initiating devices, all software functions, all other system functions including alarm communicator transmitter communication, and verify system operational matrix. Notify Owner and Engineer 2 weeks in advance of this test to permit witness observation.
  - 5. Print a System Status and Programming Report with settings for each alarm indicating device, the current sensitivity of each analog addressable smoke detector, and detailed system operational matrix.
  - 6. Factory-authorized service representative shall prepare the NFPA 72 "Fire Alarm System Record of Completion" form. Submit "Fire Alarm System Record of Completion" form to Engineer for delivery to Owner.
  - 7. After 100% system test and submission of "Fire Alarm System Record of Completion" form, request Engineer to schedule an AHJ acceptance inspection, a minimum of 2 days after completion of system testing.

8. For AHJ acceptance inspection, perform sampling testing as directed by AHJ for detectors and functional tests. Provide 2-way radios, ladders, smoke source, and other materials needed for testing the system.
  - G. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
  - H. Fire-alarm system will be considered defective if it does not pass tests and inspections.
  - I. Prepare test and inspection reports.
- 3.7 TRAINING / DEMONSTRATION**
- A. Engage a factory-authorized service representative to train Owner's maintenance personnel for a minimum of 8 hours to adjust, operate, and maintain fire-alarm system. Training schedule must be coordinated to meet the Owner's schedule. Training location will be provided by the Owner.
  - B. As a minimum, training shall cover:
    1. System software multiple access levels via password protection for accommodating Owner capability for disabling individual alarm inputs or normal outputs for alarms without modifying the system programming or affecting operation of the remainder of the system.
    2. Overall system concepts, capabilities, and functions. Training shall be of sufficient detail so that the Owner shall be able to remove any device from service and return to service without the need for the Manufacturer's approval or assistance.
    3. Methods and means of troubleshooting and replacement of all field wiring devices.
    4. Methods and means of troubleshooting the main FACU and field devices for programming, bussing systems, internal panel and unit wiring, circuitry, and interconnections.
    5. Preventative maintenance service techniques and schedules, including historical data trending of alarm and trouble records.
    6. Training documentation and actual system software used for training shall be provided in digital form and left with the Owner at the completion of training.
  - C. Provide two bound copies of training information.

**END OF SECTION**

**SECTION 28 5000  
EMERGENCY RESPONDER COMMUNICATION COVERAGE SYSTEM**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. North Carolina State Highway Patrol document with information for Viper radio system call signs and locations of tower sites accessible within Brunswick County (attached for reference after this Section).

**1.2 SUMMARY**

- A. Section Includes:
  - 1. In-building radio signal amplification system.
  - 2. A system shall be provided to cover new building.
- B. Related Sections include the following:
  - 1. Section "Basic Electrical Materials and Methods" for supports, anchors, and identification products.
  - 2. Section "Conductors and Cables" for power supply circuitry.
  - 3. Section "Grounding and Bonding".
  - 4. Section "Raceways and Boxes".

**1.3 DEFINITIONS**

- A. AHJ: Authority Having Jurisdiction
- B. BDA: Bi-Directional Amplifier: Device used to amplify band-selective or multi-band RF signals in the uplink, to the base station and in the downlink from the base station to subscriber devices for enhanced signals and improved coverage
- C. DAS: Distributed Antenna System
- D. FCC: Federal Communications Commission
- E. RF: Radio Frequency

**1.4 ACTION SUBMITTALS**

- A. RF Surveys / Shop Drawings: Measurement drawings of each floor of the building which indicate relative RF field strength for each frequency and band of interest. Submit to both the AHJ and the Engineer.
  - 1. Initial signal strength mapping.
  - 2. Pre-final signal strength mapping.
- B. Shop Drawings:
  - 1. Include plans and details for code compliant, UL Listed, DAS system design for emergency responder radio coverage.
- C. Product Data:
  - 1. Include bill of materials for all BDA / DAS equipment and components.
  - 2. Manufacturer product data sheets and cut sheets for all equipment and components.

**1.5 INFORMATIONAL SUBMITTALS**

- A. Sample Warranty: Manufacturer's standard warranty.
- B. Retransmission Authorization form signed by Viper for radio system.

**1.6 CLOSEOUT SUBMITTALS**

- A. RF Survey / Shop Drawings: Final installed measurement drawings of each floor of the building which indicate relative RF field strength for each frequency and band of interest.

- B. Operation and Maintenance Data: For all system equipment and components to include in emergency, operation, and maintenance manuals.
  - 1. Provide RF field surveys with Operation and Maintenance data.

### **1.7 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

### **1.8 WARRANTY**

- A. Special Warranty: Manufacturer agrees to repair or replace components that fail in materials or workmanship within a specified warranty period.
  - 1. Warranty Period: Two years from date of Final Completion and Acceptance by the Owner and NC State Construction Office.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. Provide an in-building radio signal amplification system to provide complete coverage in the building for the public safety agencies. System shall meet the requirements of:
  - 1. The local AHJ.
  - 2. FCC.
  - 3. The North Carolina Fire Code.
  - 4. NFPA 72, National Fire Alarm and Signaling Code.
    - a. In accordance with NFPA 72, emergency responder radio coverage systems must be designed, installed, and maintained in accordance with NFPA 1221, Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems.
  - 5. UL 2524, Standard for In-building 2-Way Emergency Radio Communication Enhancement Systems.
- B. All system coaxial cables shall be plenum rated.
- C. Donor antenna cable and riser coaxial cables shall be rated as riser cables and routed through 2-hour-rated enclosures.
- D. Connections between riser coaxial cables and horizontal coax cables to system antennas shall be made within 2-hour-rated enclosures.

## **PART 3 - EXECUTION**

### **3.1 RF FIELD SURVEYS**

- A. Perform initial signal strength mapping on-site field surveys to determine if a system is required due to inadequate radio signal coverage.
- B. Perform pre-final signal strength mapping on-site field surveys for a final determination of whether or not a system is required. If a system is required, signal strength mapping performed should serve to provide data suitable to prepare system designs.

### **3.2 EXAMINATION**

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.3 INSTALLATION**

- A. Install system equipment and components.
- B. Coordinate infrastructure needs for system installation.
- C. Grounding:
  - 1. Ground and bond coax cable shield and associated metallic conduits.

2. Ground and bond coax cable surge suppressor and associated metallic conduits.

**3.4 IDENTIFICATION**

- A. Identify and mark equipment and components with engraved labels as specified in Section "Electrical Identification".

**3.5 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to:
  1. Test and adjust equipment and components.
  2. Perform startup and commissioning of system.
- B. Tests and Inspections:
  1. Perform final testing for the local inspection authority, including final signal strength mapping.
  2. Perform final testing and demonstration with the AHJ.
  3. Submit final signal strength mapping results shop drawings.

**END OF SECTION**

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**SECTION 31 20 00**  
**EARTH MOVING**

**1. GENERAL**

- 1.1 DESCRIPTION: Perform site preparations, excavation, filling and grading of all materials encountered and to depths required to complete the work as shown on the Drawings.
- 1.2 EXISTING CONDITIONS: Every reasonable effort has been made to provide accurate information on existing site conditions. The Contractor should become familiar with the site and satisfy himself as to the scope of the work involved and the materials to be encountered. Any significant change in conditions should be immediately brought to the attention of the Owner's representative.

**2. PRODUCTS**

**2.1 SOILS**

- 2.1.1 General: Use soils free of organic matter, refuse, rocks and lumps greater than 4 inches in diameter and other deleterious matter.
- 2.1.2 Classification: For the purpose of this specification, soils to be used as fill material are grouped into seven classes according to soil properties and characteristics.
- Class I Clean gravel complying with NCDOT, coarse aggregate No. 78M.
  - Class II Clean sand complying with ASTM C33, fine aggregate.
  - Class III Clean gravel and sands complying with ASTM D2487, types GW, GP, SW, and SP.
  - Class IV Soil mixtures complying with ASTM D2487, types GM, GC, SM, SC.
  - Class V Soil mixtures complying with ASTM D2487, types ML and CL.
  - Class VI Soil mixtures complying with ASTM D2487, types MH and CH.
  - Class VII Organic soil mixtures complying with ASTM D2487, types OL, OH, and PT.
- 2.1.3 Topsoil: Natural, friable soil free of subsoil, stumps, rocks larger than 2 inches in diameter, weeds and other material detrimental to plant growth.
- 2.1.4 Granular Fill: Granular fill under floor slabs shall be Class I or II material.
- 2.1.5 Structural Fill: Fill material placed beneath and to a point 5 feet outside the line of the building foundation or slab shall be Class I, II, or III.
- 2.1.6 Fill Beneath Pavement: Fill material used beneath pavement and for road shoulders shall be Class III or IV.

2.1.7 General Fill: General fill material not otherwise specified shall be Class III, IV, or V.

2.1.8 Trench Backfill: Material used for bedding, haunching, and initial backfill shall be as specified hereinafter.

### **3. EXECUTION**

#### **3.1 GENERAL**

3.1.1 Familiarization: Prior to commencement of the earthwork, become thoroughly familiar with the site, the site conditions, and all portions of the work specified in this Section.

3.1.2 Approvals: Backfilling and grading operations in and around foundations, walls, pipes, and other portions of the work to be covered shall not commence until the Owner's representative has completed all required inspections, tests, and approvals. Work covered prior to inspection shall be uncovered for inspection purposes and backfilled.

3.1.3 Underground Utility Location: Prior to any excavation or grading work, notify the Brunswick Community College and the North Carolina One-Call Center at (800) 632-4949 for underground utility line location. Abide by their specifications for notification and accuracy.

#### **3.2 SURFACE PREPARATION**

3.2.1 Clearing: Areas designated for clearing and required for construction operations shall be cleared of trees, brush, structures, and other materials. Trees that are to remain shall be protected during clearing operations and subsequent work by installing tree protection fence at dripline of the trees.

3.2.2 Grubbing: Roots, stumps and other materials shall be grubbed from the cleared areas to a depth of at least 18 inches. Tree stumps shall be grubbed in their entirety, including taproots where applicable.

3.2.3 Topsoil: Strip existing topsoil to a depth of 4 inches from areas to be excavated or graded. Stockpile the topsoil in a suitable area for use during final grading operations. Protect the topsoil from excessive erosion.

3.2.4 Unsuitable Material: Remove sod, muck or other unsuitable material to firm subsoil in areas designated for filling or grading operations.

3.2.5 Disposal: Trees, stumps, roots, rubbish, unsuitable soil or other material resulting from surface preparation shall be removed from the site and disposed by the contractor.

#### **3.3 EXCESS WATER CONTROL**



- 3.3.1 General: Grade and maintain all areas of the site to preclude surface run-off into excavations and prevent ponding of water, and direct all concentrated flow through erosion control measures.
- 3.3.2 Dewatering: Excavations should be kept free of surface water and/or groundwater. Provide and maintain at all times the necessary means and devices to prevent water from entering the excavations and for removing all water entering the excavations. All additional cost associated with dewatering will be the responsibility of the contractor.
- 3.3.3 Softened Subgrade: Remove all soil softened or eroded by the presence of water and replace with suitable backfill material.

#### 3.4 EXCAVATION

- 3.4.1 General: All excavation of every description and of whatever substances encountered shall be performed to the line and depths indicated on the Drawings and required for the work. During excavation, material suitable for filling shall be stockpiled in an orderly manner. Excavated materials not required or suitable for filling shall be removed from the site and disposed of.
- 3.4.2 Unsuitable Material: Unsuitable materials encountered in an excavation shall be removed as directed by the Owner's Representative, backfilled with suitable material, and compacted. Unsuitable materials include organic soils, muck, soft and compressible silts and clays, and running sands.

#### 3.5 PREPARATION OF SUBGRADE

- 3.5.1 General: Upon completion of site preparation and excavation, scarify to a depth of 12 inches and compact as specified. For areas to receive fill, the compacted subgrade shall be scarified to a depth of four inches prior to placing the fill.

#### 3.6 FILL AND COMPACTION

- 3.6.1 Fill: Place and compact fill material in layers not exceeding eight inches uncompacted depth. Place the first layer of fill to an uncompacted depth of four inches and mix thoroughly with the scarified subgrade prior to compaction.
- 3.6.2 Moisture Conditioning: Moisten or aerate the subgrade and fill material as required to obtain optimum moisture content for proper compaction.
- 3.6.3 Structural Fill: Compact the subgrade and fill to a minimum of 98 percent ASTM D698 (Standard Proctor) maximum density at optimum moisture content. Compact the upper 12 inches to 100% ASTM D698 maximum density.

3.6.4 Granular Fill: Place granular fill on compacted, unscarified fill or subgrade and compact to a minimum 100 percent ASTM D698, maximum density at optimum moisture content.

3.6.5 Pavement Area: Compact the subgrade and fill material beneath paved areas and shoulders to a minimum 98 percent ASTM D698 maximum density at optimum moisture content.

3.6.6 Landscaped Areas: Compact the subgrade and fill to a minimum 90 percent and topsoil to 85 percent ASTM D698 maximum density at optimum moisture content.

### 3.7 FINISH GRADING

3.7.1 General: Perform finish grading to the lines and grades shown on the drawings. Finished grades should be smooth and uniform and provide positive drainage.

3.7.2 Tolerances:

- Rough Grade
  - Building and parking areas: Plus or minus 0.1 ft.
  - Landscaped Areas: Plus or minus 0.1 ft.
- Finish Grade
  - Building and parking areas: Plus or minus .05 ft.
  - Landscaped Areas Plus or minus 0.1 ft.

3.7.3 Topsoil: The top 4 inches of soil in landscaped areas shall be topsoil.

### 3.8 TRENCHING, BACKFILLING AND COMPACTION FOR UTILITY SYSTEMS

3.8.1 General: Refer to specific utility sections in these Specifications for installation requirements. Trench, backfill, and compact as specified except as modified herein.

3.8.2 Trenching: Trench widths at and below the top of the pipe shall be the minimum necessary for proper installation. Trench banks above the top of the pipe shall be as vertical as practicable. Overdepth excavation shall be backfilled with Class I material and compacted. The Contractor shall provide, at his expense and as directed by the Contractor's independent soils and testing firm, special bedding material or concrete encasement as may be necessary due to overwidth excavation.

3.8.3 Depth: Trench to the lines and grades shown on the drawings. Where elevations are not shown, trench to a depth sufficient to provide at least 36 inches of cover above the top of pipe, unless otherwise specified. Grade trenches to provide a constant slope free of sags and high spots.

- 3.8.4 Dewatering. Keep trenches free of water in accordance with Paragraph 3.3.
- 3.8.5 Trench Bracing: Properly brace, sheet and support trench walls as soil conditions indicate and in strict conformance with all pertinent laws and OSHA regulations. Provide adequate bracing and shoring to protect adjacent improvements.
- The Contractor shall be responsible for stabilizing, sheeting, shoring and underpinning all existing and proposed features onsite and offsite as required during the project. The design of any stabilizing, sheeting, shoring or underpinning work required for this project shall be the Contractor's responsibility and shall be designed by a North Carolina Registered Engineer.
- 3.8.6 Bedding. Tamp subgrade (trench bottom) to provide firm, even bedding. Excavate bedding material to match shape of the bottom of the pipe and bell.
- 3.8.7 Haunching. Place haunching material to provide full bearing around the bottom of the pipe and spring line.
- 3.8.8 Initial Backfill. Place initial backfill as specified in paragraph 3.8.7 and paragraph 3.8.8.
- 3.8.9 PVC Gravity Sewer Pipe:
- In trenches where groundwater is not present at or above the bottom of the trench, or if Class V, VI and VII materials are not encountered:
  - Class I, II, III, or IV materials are acceptable for bedding
  - Haunching and initial backfill shall be Class I, II, III, or IV compacted to minimum 98 percent ASTM D698 density.
- 3.8.10 Where ground water table is present at or above the bottom of the trench, or if Class V, VI, and VII materials are encountered:
- Provide 4 inches of Class I bedding material compacted to a minimum of 98 percent ASTM D698 density.
  - Haunching and initial backfill shall be Class I material placed in 6 inch maximum lifts to 6 inches above the pipe and compacted to a minimum 95 percent ASTM D698 density.

3.8.11 Ductile Iron Pipes:

- In all cases haunching and initial backfill shall be Class I, II, III, or IV placed in 6 inch maximum lifts to a level of 6 inches above the top of pipe and compacted to a minimum 95 percent ASTM D698 density.
- Where ground water is present at or above the bottom of the trench, or if Class V, VI, and VII materials are encountered, provide 4 inches of Class I bedding material compacted to a minimum of 98 percent ASTM D698 density.

**END OF SECTION**

**SECTION 31 3116  
TERMITE CONTROL**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Chemical soil treatment.

**1.02 RELATED REQUIREMENTS**

- A. Section 03 3000 - Cast-in-Place Concrete: Vapor barrier placement under concrete slab-on-grade.

**1.03 REFERENCE STANDARDS**

- A. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act; 2019.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.
- C. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements.
- D. Test Reports: Indicate regulatory agency approval reports when required.
- E. Manufacturer's Certificate: Certify that toxicants meet or exceed specified requirements.
- F. Certificate of compliance from authority having jurisdiction indicating approval of toxicants.
- G. Manufacturer's Instructions: Indicate caution requirement.
- H. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three (3) years of documented experience and approved by manufacturer.
- I. Warranty: Submit warranty and ensure that forms have been completed in Owner's name.

**1.05 WARRANTY**

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide ten year installer's warranty against damage to building caused by termites.
  - 1. Include coverage for repairs to building and to contents damaged due to building damage. Repair damage and, if required, re-treat.
  - 2. Inspect annually and report in writing to Owner. Provide inspection service for ten years from Date of Substantial Completion.

**PART 2 PRODUCTS**

**2.01 CHEMICAL SOIL TREATMENT**

- A. Toxicant Chemical: EPA Title 7, United States Code, 136 through 136y approved; synthetically color dyed to permit visual identification of treated soil.
- B. Diluent: Recommended by toxicant manufacturer.
- C. Manufacturers:
  - 1. Bayer Environmental Science Corp: [www.backedbybayer.com/pest-management/#sle](http://www.backedbybayer.com/pest-management/#sle).
  - 2. FMC Professional Solutions: [www.fmcprosolutions.com/#sle](http://www.fmcprosolutions.com/#sle).
  - 3. Syngenta Professional Products: [www.syngentaprofessionalproducts.com/#sle](http://www.syngentaprofessionalproducts.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.
- D. Mixes: Mix toxicant to manufacturer's instructions.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify final grading is complete.

**3.02 APPLICATION - CHEMICAL TREATMENT**

- A. Comply with requirements of U.S. EPA and applicable state and local codes.
- B. Spray apply toxicant in accordance with manufacturer's instructions.
- C. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.
- D. Re-treat disturbed treated soil with same toxicant as original treatment.
- E. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

**3.03 PROTECTION**

- A. Do not permit soil grading over treated work.

**END OF SECTION**

**SECTION 32 10 00**  
**BASES, BALLASTS, AND PAVING**

**1. GENERAL**

- 1.1 DESCRIPTION: The Work consists of provision and installation of aggregate base course and asphalt surface course, repair of cut or damaged asphalt pavement, pavement marking, installation of monument castings, and related work.
- 1.2 STANDARD SPECIFICATION: All materials provided and construction performed as a part of the Work described in this Section shall conform to the requirements of the North Carolina Department of Transportation "Standard Specifications For Roads And Structures" (NCDOT), latest edition; except as required herein or on the Drawings. References to methods of measurement and payment are not applicable. Pavement markings and traffic control devices shall be in accordance with the AASHTO "Manual of Uniform Traffic Control Devices," (MUTCD).

**2. PRODUCTS**

- 2.1 AGGREGATE BASE COURSE: NCDOT Section 510, Type ABC.
- 2.2 ASPHALT CONCRETE COURSE: NCDOT Section 600, Type SF 9.5A.
- 2.3 TACK COAT: NCDOT Section 605, all grades.
- 2.4 MONUMENT CASTINGS: Gray cast iron, ASTM A48, Class 30 round with 15 inch I.D. and 7 1/2 inches high.
- 2.5 PAVEMENT MARKINGS: Ready mixed type paint, NCDOT Section 1087-2(A) & Fed. Spec. TT-P-115F, white or yellow as required. Thermoplastic markings (NCDOT1087-2B) shall be used for all public streets and markings on driveways within a public right-of-way.

**3. EXECUTION**

- 3.1 GENERAL: Contractor is responsible for notifying review agencies of the construction progress and the need for periodic inspections. Contractor shall notify Owner or Owner's surveyor for installation of monuments within the right-of-way.
- 3.2 SUBGRADE: Compact subgrade as required in SECTION 31 20 00 EARTH MOVING and NCDOT Section 500. Areas which are unstable or pump shall be excavated, backfilled, and recompactd.
- 3.3 AGGREGATE BASE COURSE: Construct in accordance with NCDOT Section 520. Base course to extend full depth beneath and 6 inches outside all curbing and pavement edges.

- 3.4 BITUMINOUS SURFACE COURSE: Construct in accordance with NCDOT Sections 610 and 645. No prime coat shall be required prior to placing surface course over aggregate base course. A tack coat in accordance with NCDOT Section 605 shall be provided where surface course is placed on existing bituminous pavement or abuts to existing bituminous or concrete materials.
- 3.5 MONUMENT CASTINGS: Install castings upon completion and installation of base course and prior to placing surface course. Castings shall have a 4-inch thick by 12-inch wide concrete footing beneath entire outside perimeter, and shall be adjusted to grade with brick or block, grouted in place. Castings shall be centered on the monuments.
- 3.6 ADJUSTMENT OF FRAMES, GRATES, AND CASTINGS: Adjust frames, grates, and castings to meet finish grade in accordance with NCDOT Section 858.
- 3.7 SHOULDER GRADING: Construct in accordance with NCDOT Section 560. Fill material shall be topsoil free of roots and rocks greater than 0.5 inches in diameter.
- 3.8 PAVEMENT MARKINGS: Provide pavement markings in accordance with the MUTCD, NCDOT Section 1205, and as shown on the Drawings. Markings are not required on public or private streets unless noted otherwise on the Drawings. Parking lot markings will be white or yellow as shown on the plans.

**END OF SECTION**



## **SECTION 32 1313 CONCRETE PAVING**

### **1. GENERAL**

- 1.1 DESCRIPTION: Work described in this section is portland cement concrete paving, including concrete walkways.
- 1.2 Standard Specification: Provisions of the American Concrete Institute (ACI) and American Concrete Pavement Association "Municipal Concrete Pavement Manual" (ACPA) are included by reference.

### **2. PRODUCTS**

- 2.1 Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends as required. Coat forms with a non-staining form release agent that will not discolor or deface surface of concrete.
- 2.2 Concrete Materials: ACI 318, minimum compressive strength of 3000 psi at 28 days, with slump range from 3 to 4 inches. Air content 5% to 8%.
- 2.3 Expansion Joint Materials: Preformed expansion joint fillers ASTM D1751 and sealers, ASTM C920.
- 2.4 Liquid-Membrane Forming Curing Compound: Complying with ASTM C309, Type I, Class A.
- 2.5 Bonding Compound: Polyvinyl acetate or acrylic base, rewettable type.
- 2.6 Epoxy Adhesive: ASTM C881, two component material suitable for use on dry or damp surfaces. Provide material "Type", "Grade", and "Class" to suit project requirements.
- 2.7 REINFORCING STEEL
  - 2.7.1 Wire Fabric: ASTM A185.

### **3. EXECUTION**

- 3.1 Surface Preparation: Remove loose material from compacted subbase surface immediately before placing concrete. Do not begin paving work until subbase is ready to receive paving. Stringlines will be required to assure proper depth of concrete on all slabs. Absolutely no tolerance will be allowed on minimum slab thickness.

- 3.2 Form Construction: Set forms to required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement. Check completed formwork for grade and alignment to following tolerances:
- 3.3 Top of forms not more than 1/8" in 10'.
- 3.4 Vertical face on longitudinal axis, not more than 1/4" in 10'.
- 3.5 Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.

### 3.3 CONCRETE PLACEMENT:

- 3.3.1 General: Comply with requirements of ACI 318 for mixing and placing concrete, and as herein specified. Do not place concrete until subbase and forms have been checked for line and grade. Moisten subbase if required to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment. Use bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces. Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hour, place a construction joint. Vibrate all concrete in place to assure proper consolidation.

### 3.4 JOINTS

- 3.4.1 General: Construct expansion, weakened-plane (contraction), and construction joints true-to-line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated. When jointing existing structures, place transverse joints to align with previously placed joints, unless otherwise indicated. Joints in sidewalks shall be spaced 6 feet on center.

- 3.4.2 Weakened-Plane (Contraction) Joints: Provide weakened-plane (contraction) joints to a depth equal of at least 1/4 concrete thickness, as follows:

Tooled Joints: Form weakened-plane joints in fresh concrete by grooving top portion with a cutting tool and finishing edges with a jointer.

Sawed Joints: Form weakened-plane joints using powered saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into hardened concrete as soon as surface will not be torn, abraded, or otherwise damaged by cutting action.

Inserts: Use embedded strips of metal or sealed wood to form weakened-plane joints. Set strips into plastic concrete and carefully remove strips after concrete has hardened.

- 3.4.3 Construction Joints: Place construction joints at end of placements and at locations where placement operations are stopped for a period of more than 1/2 hour, except where such placements terminate at expansion joints.
- 3.4.4 Expansion Joints: Provide premolded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks and other fixed objects, unless otherwise indicated. Locate expansion joints at 50' o.c. unless otherwise indicated. Extend joint fillers full-width and depth of joint, and not less than 1/2" or more than 1" below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler flush with finished concrete surface. Furnish joint fillers in one-piece lengths for full width being placed.
- 3.4.5 Fillers and Sealants: Prior to filling or sealing, remove all foreign material from joints and pavement. Apply fillers and sealers in accordance with the manufacturer's recommendations.
- 3.5 CONCRETE FINISHING: After striking-off and consolidating concrete, smooth surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish. Work edges of slabs, and formed joints with an edging tool, and round to 1/2" radius, unless otherwise indicated. Eliminate tool marks on concrete surface. After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:
- Broom finish, by drawing a fine-hair broom across concrete surface, perpendicular to line of traffic. Repeat operation if required to provide a fine line texture.
- Burlap finish, by dragging a seamless strip of damp burlap across concrete, perpendicular to line of traffic. Repeat operation to provide a gritty texture.
- Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Engineer.
- 3.6 CURING: Protect and cure finished concrete paving, complying with applicable requirements of ACI 318. Use membrane-forming curing and sealing compound or approved moist-curing methods.
- 3.7 REPAIRS AND PROTECTIONS
- 3.7.1 Repair and replace broken or defective concrete. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as

possible by removing surface stains and spillage of materials as they occur. Sweep concrete pavement and wash free of stains, discolorations, dirt and other foreign material just prior to final inspection.

- 3.7.2 Drill test cores where directed by Engineer, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.

**END OF SECTION**

**SECTION 32 8423  
UNDERGROUND SPRINKLERS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Pipe and fittings, valves, sprinkler heads, emitters, bubblers, and accessories.
- B. Control system.

**1.02 REFERENCE STANDARDS**

- A. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series); 2020.
- B. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2020.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

**1.03 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination: Coordinate the work with site backfilling, landscape grading and delivery of plant life.
- B. Preinstallation Meeting: Convene one week prior to commencing work of this Section.

**1.04 SUBMITTALS**

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component and control system and wiring diagrams.
- C. Shop Drawings: Indicate piping layout to water source, location of sleeves under pavement, location and coverage of sprinkler heads, components, plant and landscaping features, site structures, schedule of fittings to be used.
- D. Operation and Maintenance Data:
  - 1. Provide instructions for operation and maintenance of system and controls, seasonal activation and shutdown, and manufacturer's parts catalog.
  - 2. Provide schedule indicating length of time each valve is required to be open to provide a determined amount of water.
- E. Record Documents: Record actual locations of all concealed components piping system.
- F. Maintenance Materials: Provide the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Sprinkler Heads: One of each type and size.

**1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

**PART 2 PRODUCTS**

**2.01 IRRIGATION SYSTEM**

- A. Manufacturers:
  - 1. Rain Bird Sales, Inc: [www.rainbird.com/#sle](http://www.rainbird.com/#sle).
  - 2. Toro Company: [www.toro.com/#sle](http://www.toro.com/#sle).
  - 3. Weathermatic: [www.weathermatic.com/#sle](http://www.weathermatic.com/#sle).
  - 4. Substitutions: See Section 01 6000 - Product Requirements.

**2.02 PIPE MATERIALS**

- A. PVC Pipe: ASTM D2241; 200 psi pressure rated upstream from controls, 160 psi downstream; solvent welded sockets.
- B. Fittings: Type and style of connection to match pipe.
- C. Solvent Cement: ASTM D2564 for PVC pipe and fittings.

- D. Sleeve Material: PVC.

### **2.03 OUTLETS**

- A. Rotary Type Sprinkler Head: Fixed type with screens; fully adjustable for flow and pressure; size as indicated; with letter or symbol designating degree of arc and arrow indicating center of spray pattern.
- B. Emitter: Adjustable outlet, non-clogging, with two trickle tubes.
- C. Bubbler: Adjustable outlet and \_\_\_\_\_.

### **2.04 VALVES**

- A. Valve Box and Cover.

### **2.05 CONTROLS**

- A. Controller: Automatic controller, microprocessor solid state control with visible readout display, temporary override feature to bypass cycle for inclement weather, timer for a 4 station system, programmable for 7 days in quarter hour increments, with automatic start and shutdown.
- B. Controller Housing: NEMA 250 Type 3; weatherproof, watertight, with lockable access door.
- C. Wire Conductors: Color coded.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify location of existing utilities.
- B. Verify that required utilities are available, in proper location, and ready for use.

### **3.02 PREPARATION**

- A. Layout and stake locations of system components.
- B. Review layout requirements with other affected work. Coordinate locations of sleeves under paving to accommodate system.

### **3.03 TRENCHING**

- A. Trench to accommodate grade changes and slope to drains.
- B. Maintain trenches free of debris, material, or obstructions that may damage pipe.

### **3.04 INSTALLATION**

- A. Install pipe, valves, controls, and outlets in accordance with manufacturer's instructions.
- B. Connect to utilities.
- C. Set outlets and box covers at finish grade elevations.
- D. Provide for thermal movement of components in system.
- E. Use threaded nipples for risers to each outlet.
- F. After piping is installed, but before outlets are installed and backfilling commences, open valves and flush system with full head of water.

### **3.05 FIELD QUALITY CONTROL**

- A. Field inspection and testing will be performed under provisions of Section 01 4000 - Quality Requirements.
- B. Prior to backfilling, test system for leakage at main piping to maintain 100 psi pressure for one hour.

### **3.06 BACKFILLING**

- A. Provide 3 inch sand cover over piping.
- B. Backfill trench and compact to specified subgrade elevation. Protect piping from displacement.

**3.07 SYSTEM STARTUP**

- A. Prepare and start system in accordance with manufacturer's instructions.
- B. Adjust control system to achieve time cycles required.
- C. Adjust head types for full water coverage as directed.

**3.08 CLOSEOUT ACTIVITIES**

- A. Instruct Owner's personnel in operation and maintenance of system, including adjusting of sprinkler heads. Use operation and maintenance data as basis for demonstration.

**END OF SECTION**

**SECTION 33 05 07.13**  
**DIRECTIONAL DRILLING**

**1. GENERAL**

- 1.1 DESCRIPTION: Technical guidance for use of directional drilling to install utilities under pavements.
- 1.2 The intent of this specification is to provide general technical guidance to the utility contractor for the installation of pipelines using horizontal directional drilling (HDD) techniques.
- 1.3 The utility contractor shall furnish all labor, materials, equipment, and incidentals required to successfully perform the installation of water, wastewater, and reclaimed water mains at locations shown on the plans by using horizontal directional drilling (HDD) methods.
- 1.4 The pipeline shall be complete with all accessories and shall have passed all required testing per the contract documents and other county requirements.
- 1.5 The utility contractor shall have made all inspections of the area(s) within the vicinity of the project and the immediate area of the work and become thoroughly familiar with the natural and manmade features encompassed about the project.

**2. QUALITY ASSURANCE**

**2.1 REQUIREMENTS**

- 2.1.1 At the discretion of the Engineer, it may be required that the utility contractor be prequalified and approved through a prequalification process. The utility contractor must furnish references able to attest to his capabilities in accordance with the prequalification process.
- 2.1.2 The utility contractor shall comply with North Carolina OSHA Standards, Underwriter Laboratories standards, and other requirements of the Authority Having Jurisdiction (AHJ).

**2.2. REFERENCE STANDARDS**

- 2.2.1 Comply with applicable provision and recommendations of the following, except as otherwise shown or specified:



2.2.1.1 ASTM D-1248 and D-3350

2.2.1.2 AWWA C901 or C906

2.2.1.3 NSF 61

2.2.1.4 ASTM D2683 or D3261

### **3. REQUIRED SUBMITTALS**

3.1 The utility contractor shall submit the following items to the Engineer for review and approval:

3.1.2 Pipe material shop drawings

3.1.3 Manufacturer's Installation Manual

3.1.4 Certificates: Submit certificates of compliance with referenced standards where requested by the engineer

3.1.5 Field installation drawings indicating layout and depth of directionally drilled pipe.

3.1.6 Record Drawings: During progress of the work, keep an up to date set of drawings showing field and shop drawing modifications including the drilling logs. The drawings shall show all piping on plans and in sections, with all reference dimensions and elevations required for complete record drawings of the directionally drilled pipe including the drilling logs to be included on the record drawings.

3.1.7 Erosion control plan for the drilling mud pit work area

3.1.8 Frack out containment plan for the drilling area

3.1.9 Written verification of required pressure testing per county specifications

3.1.10 Work Plan: Prior to beginning work, the Contractor shall submit to the Engineer a work plan detailing the procedure and schedule to be used to execute the project. The work plan should include a description of all equipment to be used, down-hole tools, a list of personnel and their qualifications and experience (including back-up personnel

in the event that an individual is unavailable), list of subcontractors, a schedule of work activity, a safety plan (including MSDS of any potentially hazardous substances to be used), traffic control plan (if applicable), an environmental protection plan and contingency plans for possible problems. Work plan should be comprehensive, realistic, and based on actual working conditions for this particular project. Plan should document the thoughtful planning required to successfully complete the project.

- 3.1.11 Equipment: the utility contractor shall submit specifications on directional drilling equipment to be used to ensure that the equipment will be adequate to complete the project. Equipment shall include but not be limited to: drilling rig, mud system, mud motors (if applicable), down-hole tools, guidance system, and rig safety systems. Calibration records for guidance equipment shall be included. Specifications for any drilling fluid additives that the utility contractor intends to use or might use will be submitted. Specifications on material to be used shall be submitted to engineer. Material shall include the pipe, fittings, and any other item which is to be an installed component of the project.
- 3.1.12 Guidance System: A Magnetic Guidance System (MGS) probe or proven gyroscopic probe and interface shall be used to provide a continuous and accurate determination of the location of the drill head during the drilling operation. The guidance shall be capable of tracking at all depths up to fifty (50) feet and in any soil condition, including hard rock. It shall enable the driller to guide the drill head by providing immediate information on the tool face, azimuth (horizontal direction) and inclination (vertical direction). The guidance system shall be accurate up to +/- 2% of the vertical depth and accurate to within two and one-half (2 ½) feet horizontally from the horizontal alignment shown on the drawings.

#### **4. MATERIALS**

- 4.1 HDPE: Material shall be high-density polyethylene, extra high molecular-weight, PE3408 pressure rated 200 psi, minimum DR- 9, as manufactured by Plexco or equal.
- 4.2 Fusible PVC: Material shall be fusible C-900 or C-905 polyvinyl chloride (PVC), minimum DR-18, rated 150 psi (C900) or 235 psi (C905), as manufactured by Underground Solutions, Inc., or approved equal.
- 4.3 Pipe shall be heat fusion welded per the manufacturer's instructions.
- 4.4 Mechanical fittings shall be authorized by the manufacturer for use on HDPE and Fusible PVC and approved by the engineer.

## **5. TESTING AND PAYMENT**

- 5.1 Pipe shall be pressure tested after installation per Section 33 14 00 Water Utility Transmission and Distribution. If a pipe relaxation period is required, the minimum relaxation period shall be forty-eight (48) hours or the manufacturer's recommended relaxation period. After the pipe relaxation period the pipe may have its initial pressure test. If the initial pressure test is successful, the pipe shall also be connected to the water or sewer system to be tested again as part of the overall system pressure test. All connections shall be per county standard detail.
- 5.2 College staff, in addition to the engineer, shall be available during the testing for observation and documentation of the pressure test.
- 5.3 All unsuccessful pressure testing will be cause for correction by the utility contractor at no additional cost to the Owner.
- 5.4 All trenchless installations shall pass the initial hydrostatic pressure test per specifications and standard details prior to any payment to any contractor.

## **6. STORAGE AND HANDLING**

- 6.1 Handle all pipe and accessories carefully with approved handling devices. Do not drop or roll pipe off trucks. Do not otherwise drop, roll or skid pipe. Materials cracked, gouged, chipped, dented or otherwise damaged will not be approved or accepted for use on county systems.
- 6.2 Pipe and appurtenances shall be unloaded opposite to or as close to the place where they are to be laid as is practical to avoid unnecessary handling. Interiors shall be kept completely free from dirt and foreign matter.
- 6.3 The utility contractor shall be responsible for the proper support of the piping to ensure that the pipe is not over stressed or damaged in any manner.

## **7. INSTALLATION**

### **7.1 GENERAL**

- 7.1.1 The work shall be performed by the Horizontal Directional Drill (HDD) Technique.

Specific details of installation techniques are the responsibility of the utility contractor and must fully comply with the pipe manufacturer's installation recommendations. The county will not direct "means and methods" to the contractor to be used in installation of the directional drill pipe other than that pipe must be installed in accordance with the manufacturer specifications. In general, the work will proceed as follows:

- 7.1.1.1 Drill a pilot hole from one side of the crossing to the other. The pilot hole follows the design centerline of the pipe with the path recorded and controlled using a specially designed instrument package situated behind the drill bit.
- 7.1.1.2 A washover pipe is rotated over the pilot drill string behind the pilot drill bit and exits with the drill bit on the other side of the crossing.
- 7.1.1.3 The drill bit and drill string is withdrawn back through the washover pipe, leaving the washover pipe in place.
- 7.1.1.4 A series of tools are connected between the end of the washover pipe and the wastewater main and/or water main. The drilled hole is widened to its final diameter with the appropriate tool, head or cutter. Smooth the wall of the bore and direct bentonite to aid in the boring operation. A swivel is installed between the tool, head or cutter and the wastewater main and/or water main to ensure that no torque is transmitted to the pipe main.
- 7.1.1.5 After the tools are connected between the washover pipe and wastewater force main and/or water main, the drill rig will rotate and pull the washover pipe along the drilled path, with the pipe following slowly behind.
- 7.1.1.6 After the pipe is in place, and after the pipe relaxation period, if required, it shall be pressure tested.
- 7.1.1.7 A twelve (12) gauge, steel reinforced, insulated copper locator wire shall run continuously with and shall be securely fastened to the water main or forcemain.

## 7.2 DRILL PATH GEOMETRY

- 7.2.1 The utility contractor is responsible for horizontal and vertical alignment of the pilot drill and final installed pipe. The pilot drill should conform to the pipeline alignment as shown on the contract drawings. The utility contractor shall submit all proposed changes to the vertical alignment shown on the drawings to the Engineer for approval prior to commencing work. Under no circumstances shall installed pipe be at a higher elevation than that shown on the drawings or vary by more than (2 ½) feet from the horizontal alignment shown on the drawings.

- 7.2.2 The accuracy of the drill exit point shall be within a (2 ½) foot horizontal radius of the design exit point.
- 7.2.3 Entry and exit points shall be located as shown on the contract drawings.
- 7.2.4 The utility contractor shall map to scale the location of each pilot drill string joint to a minimum horizontal and vertical scale of 1 inch equals 20 feet. The map shall be furnished to the Engineer.
- 7.2.5 Should the utility contractor exceed the limits described above, a new pilot drill shall be performed at the expense of the utility contractor and at no cost to the county. The utility contractor may elect to alter the horizontal geometry of the drilling subject to right-of-way restraints. However, payment limits are based upon stations given in the bid form, and payment for directional drilling will be limited to the prices bid therein.
- 7.2.6 If requested by the Engineer, the utility contractor shall provide a full explanation of details regarding any technical means, methods or equipment necessary to accomplish the work described herein.

### 7.3 JOB CONDITIONS

- 7.3.1 Existing Utilities: The contractor shall be responsible to field locate existing underground utilities in the areas of work.
  - 7.3.1.1 Should uncharted or incorrectly charted piping or utilities been countered during the work, consult piping or utility owner and engineer immediately for instructions. Cooperate with owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
  - 7.3.1.2 Do not interrupt existing utilities serving facilities occupied and used by owner or others, except when permitted in writing by the engineer and then only after acceptable temporary utility services have been provided.
  - 7.3.1.3 Coordinate with utility companies for shut-off of services, if required.
- 7.3.2 Do not bring explosives onto site or use in the work. Use of explosive materials is specifically prohibited

7.3.3 The utility contractor shall conduct all of his operations and maintain the area of his activities, including sweeping and sprinkling of roadways, so as to minimize the creation and dispersion of dust.

#### 7.3.4 INSTALLATION SPECIALIST

7.3.4.1 The utility contractor shall provide the full-time services of a competent installation specialist during the directional drilling to assist in technical matters relating to the work. He shall advise the utility contractor on matters to include, but are not limited to, drilling, pipe support, mapping of the pipe location, quality assurance of the work, safety or other items as necessary. Installation specialist may be the contractor's superintendent.

#### 7.3.5 COMPLETION OF WORK

7.3.5.1 Interior of all pipe and fittings shall be inspected and all dirt, gravel, sand, debris, or other foreign material shall be completely removed from pipe interior. A bulkhead shall be attached to the end of the pipe prior to attaching the swivel and barrel reamer to ensure inside of pipe remains clear during pullback operation.

7.3.5.2 Install all pipes accurately to line and grade shown unless otherwise approved by the Engineer.

7.3.5.3 Any time that pipe work is not actively in progress the open ends of pipe shall be closed by a watertight cap.

7.3.5.4 Field cutting pipe, where required, shall be made with a machine specially designed for cutting piping. Cuts shall be carefully done, without damage to pipe, so as to leave a smooth end at right angles to the axis of pipe. Cut ends shall be tapered and sharp edges filed off smooth.

7.3.5.5 At completion of pipe installation, the utility contractor shall install transition fittings as required to the piping and then cap with watertight caps or plugs.

7.3.5.6 At completion of pipe installation, the utility contractor shall furnish accurate drill logs indicating placement of pipe as installed. The entire drill path shall be accurately surveyed with entry and exit stakes placed in the appropriate locations within areas indicated on drawings. If the utility contractor is using a magnetic guidance system, the drill path will be surveyed for any surface geomagnetic variations or anomalies.

### **8. ENVIRONMENTAL CONTROLS**

#### **8.1 DISPOSAL OF DRILLING MUD:**

8.1.1 The drilling mud cannot be disposed of on the project site.

- 8.1.2 Off-site disposal of the drilling mud is the utility contractor's responsibility.
- 8.1.3 The utility contractor shall comply with all applicable laws and regulations regarding the transport and off-site disposal of the drilling mud and all excess excavated materials.
- 8.1.4 All costs for proper transport and disposal of drilling mud and all excess excavated materials shall be included in the price bid for the work.
- 8.2 All operations involving drilling mud shall be controlled and monitored by the utility contractor to ensure containment:
  - 8.2.1 The utility contractor shall establish bermed or sandbagged pits of sufficient sizes to accommodate the volume of drilling mud anticipated plus a two-foot freeboard. The bermed areas shall be maintained and designed by the utility contractor to ensure containment and prevent loss of drilling mud.
  - 8.2.2 Transportation of the disposal materials off-site by public roads shall meet all North Carolina Department of Transportation requirements.
  - 8.2.3 Transportation of materials by barge or scow shall be in accordance with the Corps of Engineers and U.S. Coast Guard requirements.

## **9. ASBUILT / RECORD DRAWINGS**

- 9.1 The utility contractor shall deliver the drilling logs to the engineer for inclusion in the final as-built drawings for the project. The design profile for the directional drill installation shall be updated with the drilling log data. The drilling logs shall be incorporated in the final as-built drawings provided by the engineer.

**END OF SECTION**

**SECTION 33 14 00**  
**WATER UTILITY TRANSMISSION AND DISTRIBUTION**

**1. GENERAL**

- 1.1 DESCRIPTION: This section gives the requirements for installation of water lines, including pipe, valves, and service connections. Excavation, trenching, and backfilling is covered in SECTION 31 20 00 Earthmoving.
- 1.2 RELATED DOCUMENTS
- 1.2.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- 1.3 SUBMITTALS
- 1.3.1 Certificates of Compliance: Submit three copies of a certificate of compliance for the following items:
- Pipe
  - Service Fittings
  - Valves
  - Tapping Sleeves
  - Hydrants
  - Pipe Marking Tape
- 1.3.2 Test Reports: Submit three copies of the results of the bacteriological tests.

**2. PRODUCTS**

**2.1 PIPE & FITTINGS**

- 2.1.1 General: Water mains will be constructed of PVC pipe except where ductile iron is noted on the plans or required due to conflicts. Water service laterals 2-inches and smaller will be constructed of CTS copper tubing. All pipe and fittings shall be approved by and bear the seal of the National Sanitation Foundation (NSF).
- 2.1.2 Copper Tubing shall conform to ANSI/AWWA C800, Type K soft copper tubing.
- 2.1.3 Ductile Iron Pipe shall conform to ANSI A21.51, Class 51, 350 psi working pressure unless otherwise shown or specified.
- Joints shall be push-on joints conforming to ANSI A21.11, as modified by ANSI A21.51.



- Fittings and specials shall be mechanical joint suitable for 250 pounds per square inch pressure rating, unless otherwise specified. Fittings and specials shall conform to AWWA C110.

- Cement mortar linings and bituminous coatings for pipe and fittings shall be in accordance with applicable ANSI/AWWA specifications.

#### 2.1.4 Polyvinyl Chloride (PVC)

- 4" – 12" PVC pipe shall be elastomeric joint conforming to requirements of AWWA C900, PC150 for 4 and 12-inch pipe. 14 inch and larger AWWA C905 PC200.

- Fittings and specials shall be mechanical joint cast iron, in accordance with ANSI A21.10, 250 pounds per square inch pressure rating unless otherwise shown or specified. Fittings and specials shall be cement mortar lined (standard thickness) in accordance with ANSI 21.4.

- 2" – 3" PVC pipe shall be 200 psi SDR 21 conforming to ANSI/ASTM D2241, NSF approved with push on joints meeting ANSI/ASTM D3139.

#### 2.1.5 Tapping Saddles & Sleeves:

- Tapping Saddle: Bronze service clamp with Mueller (cc) threads, Rockwell 315, ¾ inch to 2 inch taps.

- Tapping Sleeves: Ductile iron, 150 psi working pressure, with mechanical joint connections on the tapped pipe and flanged joint for tapping valve, 4 inch and larger taps.

### 2.2 VALVES

2.2.1 Gate Valves: Iron body, bronze mounted, resilient seated in conformance with AWWA C509, with a minimum working pressure of 175 pounds per square inch. Valves shall have non-rising stem, 2-inch operating nut, open counter clockwise (left), with O-ring seals. Valve ends shall be mechanical joint, unless otherwise shown or specified.

2.2.2 Tapping Valves: Gate valves meeting specifications above designed for tapping operations, with FL by MJ joints.

2.2.3 Corporation Stops: Bronze, ground key type with Mueller (cc) threads on the inlet end and flare fitting on the outlet end, Ford B21, Mueller H 15000, or Hays 4005 or approved equal ¾ inch to 2 inch.

2.2.4 Curb Stop: Ford FB 600 Series, Mueller H 15174, or Hays 4005 or approved equal.

### 2.3 VALVE BOXES

- 2.3.1 Valve Boxes shall be cast iron telescoping type with flared base. The word "WATER" shall be cast in the cover. The boxes shall be of such length as will be adapted, without full extension, to the depth of cover required over the pipe at the valve location. Boxes shall be installed over each gate valve, unless otherwise shown or specified.

## 2.4 FIRE HYDRANTS

- 2.4.1 Fire Hydrants shall be iron body, fully bronze mounted, dry barrel type with breakaway flange and stem coupling conforming to AWWA C502, with valve opening not less than 4.5 inches in diameter. Hydrants shall have a 6-inch mechanical joint connection on the inlet end. Outlets shall be one 4.5-inch pumper connection and two 2.5-inch nozzles. Operating nut shall be solid 1 1/2 inch pentagonal with O-ring seals, opening right (clockwise). Working parts shall be bronze. Hydrants shall be Mueller, American Darling or Clow. Hydrants shall be furnished and installed to the proper bury; extension kits will not be allowed.

- 2.4.2 Fire Hydrant Paint: Two coats of the specified paint, the final coat applied after installation. Contact Brunswick Community College for paint color.

- Hydrant Barrel: Heavy-duty aluminum paint for industrial or commercial use. Rustoleum, Glidden, Tenemec or approved equal.

## 2.5 SERVICE LINE ITEMS

- 2.5.1 Meter boxes for 2-inch and smaller meters shall be oval cast iron meeting UNC-W standards.

- 2.5.2 Meter Vaults for 3-Inch and Larger Meters: Precast concrete vault, 4.5' by 8.5' by 5.0' deep I.D., with aluminum lockable hatch (H20 load rated).

- 2.5.3 Meter Coupling: Brass 5/8"x3/4"x3/4".

- 2.5.4 Meter Yoke: 5/8"x3/4", 9" riser with lock stop, Mueller H14118 or Ford V42-7W.

- 2.5.5 1½ inch and 2-inch meter connections will be made with a Mueller H-1422 meter yoke and 12-inch riser.

## 2.6 WATER METERS

- 2.6.1 Two-inch and smaller meters shall be installed in cast iron meter boxes.

- 2.6.2 Three-Inch and Larger Meters: Meter shall be a turbo meter, ANSI/AWWA C701, registering in cubic feet and shall be installed in a concrete vault.

## 2.7 DISINFECTION

2.7.1 Chlorine, Liquid: AWWA B300.

2.7.2 Hypochlorite, Calcium and Sodium: AWWA B300.

## 2.8 PIPE MARKING TAPE

2.8.1 Tape shall be minimum 3 inches wide, blue in color, bearing continuous message "CAUTION WATER LINE BURIED BELOW". Tape shall be made of plastic or other permanent material with metallized foil core.

## 2.9 PIPE MARKING WIRE

2.9.1 Wire shall be #8 copper wire and shall be installed along top of pipe. Wire shall be brought up in valves & fittings.

## 2.10 BACKFLOW PREVENTERS:

2.10.1 General: All domestic nonresidential and irrigation services require a Reduced Pressure Principle backflow preventer. All fire system services require a double check valve type.

2.10.2 Reduced Pressure Principle: FEBCO, Watts, Wilkens or approved equal.

2.10.3 Double Check Valve: FEBCO, Watts, Wilkens or approved equal.

# 3. EXECUTION

## 3.1 GENERAL

3.1.1 Install pipe in conformance with applicable sections of AWWA C600. Minimum depth of bury above the top of pipe shall be 36 inches. Install plastic pipe in conformance with ASTM D2774 and recommended practices of the UNI-BELL Plastic Pipe Association.

## 3.2 ADJACENT FACILITIES

3.2.1 Lateral Separation of Sewers and Water Mains: Water mains shall be laid at least 10 feet laterally from existing or proposed sewers, unless local conditions or barriers prevent a 10-foot separation, in which case:

- The water main is laid in a separate trench, with the elevation of the bottom of the water main at least 18 inches above the top of the sewer; or

- The water main is laid in the same trench as the sewer with the water main located at one side on a bench of undisturbed earth, and with the elevation of the bottom of the water main at least 18 inches above the top of the sewer.

3.2.2 Crossing a Water Main Over a Sewer: Whenever it is necessary for a water main to cross over a sewer, the water main shall be laid at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer, unless local conditions or barriers prevent a 18-inch separation, in which case both the water main and sewer shall be constructed of ferrous materials and with joints equivalent to water main standards for a distance of 10 feet on each side of the point of crossing.

3.2.3 Crossing a Water Main Under a Sewer: Whenever it is necessary for a water main to cross under a sewer, both the water main and sewer shall be constructed of ferrous materials and with joints equivalent to water main standards for a distance of 10 feet on each side of the point of crossing. A section of water main pipe shall be centered at the point of crossing.

- Water Lines shall not be laid in the same trench with gas lines or electric wiring.

### 3.3 JOINT DEFLECTION

3.3.1 Maximum joint deflection shall meet requirements of AWWA C600.

### 3.4 JOINTING

3.4.1 Ductile Iron Pipe: Push-on and mechanical joints shall be installed in accordance with AWWA C600, modified as necessary by the recommendations of the manufacturer.

3.4.2 Copper Pipe: Joints shall be made with suitable compression type fittings. Inserts shall be used as recommended by the fitting and pipe manufacturer.

3.4.3 Connections between different types of pipe and accessories shall be made with transition fittings approved by the Owner's Representative.

### 3.5 SERVICE LATERALS:

3.5.1 ¾ Inch to 2 Inch Services: Service laterals shall consist of a tapping saddle, corporation stop, a length of copper pipe to the meter yoke, meter yoke with angle stop and check valve, and meter box.

3.5.2 Three Inch and Larger Services: Connection to main shall be made with tapping sleeve and valve or tee and valve as necessary. Pipe to meter vault shall be PVC. Meter piping in vault shall include two gate valves for isolating meter, meter bypass with shut-off valve, and unions in piping. Pipe shall be flanged ductile iron inside vault, with mechanical joint connection to PVC outside vault.

3.5.3 Meter Vaults shall be located and installed as shown on the plans or directed by the Owner's representative. The meter box shall be set on a 6-inch bed of stone, with the top of vault 2 inches above grade in landscaped areas.

- 3.5.4 Backflow Preventers shall be located within the structure, above grade and installed in conformance with applicable plumbing code.

### 3.6 SETTING OF VALVES AND VALVE BOXES

- 3.6.1 Valves and Valve Boxes: Install where shown or directed and set plumb. Valve boxes shall be installed on and centered over each valve. Where feasible, valves shall be located outside the paved area of roads and streets, and in line with the right of way. Earth fill shall be carefully tamped around each valve box to a distance of 4 feet on all sides of the box.

- 3.6.2 Valves after delivery shall be drained to prevent freezing and shall have the interiors cleaned of all foreign matter before installation. Valves shall be fully opened and closed to insure that all parts are in working condition.

### 3.7 THRUST BLOCKS

- 3.7.1 Plugs, caps, tees, and bends deflecting 22-1/2 degrees or more on water lines 6 inches in diameter or larger shall be provided with thrust blocking. Blocking shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed the base and thrust bearing sides of thrust blocks shall be poured directly against undisturbed earth. The sides of thrust blocks not subject to thrust may be poured against forms. The area of bearing shall be as shown or as directed. Blocking shall be placed so that the fitting joints will be accessible for repair. Steel rods and clamps shall be protected by galvanizing or by coating with bituminous paint.

### 3.8 FIRE HYDRANTS

- 3.8.1 Hydrant installations shall consist of a 6-inch pipe from the main, valve, and hydrant. Locate and install as shown on the drawings and details. Provide a minimum of 30 inches of cover on the hydrant line. Hydrants shall be set plumb with the pumper nozzle facing the roadway and with the center of the lowest outlet not less than 18 inches above the finished surrounding grade, and the operating nut not more than 48 inches above the finished surrounding grade. The hydrant shall be set in a bed of crushed rock, which shall surround the barrel at least 12 inches in all directions. Hydrants shall be restrained with galvanized steel tie rods extending from main line tee to the valve and hydrant.

### 3.9 PIPE MARKING TAPE

- 3.9.1 Install tape 18 inches to 24 inches above pipe along the entire length of pipe, and above services to the meter box. Extend tape up to finish grades at valve, hydrants, and meter boxes.

- #8 Copper wire shall be installed along top of pipe. Wire shall be brought up in all fitting & valves. Wire can be attached to pipe with duct tape. Splice connections shall use direct burial connectors double wrapped in electrical tape.

### 3.10 HYDROSTATIC TESTS

- 3.10.1 General: Where any section of a water line is provided with concrete thrust blocking the hydrostatic test shall not be made until at least 5 days after installation of the concrete thrust blocking unless otherwise approved. Use clean potable water for all testing of lines.
- 3.10.2 Pressure Test: Pressure test in strict conformance with AWWA C600, Section 4.1, except as revised herein. For purposes of testing, working pressure shall be 100 psi and test pressure shall be 150 psi. Minimum duration for pressure test shall be two hours.
- 3.10.3 Leakage Test: Test for leakage concurrent with the pressure test and in strict conformance with AWWA C600, Section 4.1. Leakage shall not exceed 0.09 gallons per hour per inch diameter per 1000 feet. Remedy all visible leaks and locate and repair leakage in lines that exceed the specified amounts.

### 3.11 DISINFECTION

- 3.11.1 General: Hydrostatic tests and disinfection may be conducted concurrently, using the water treated for disinfection to test the lines. If water is lost during the test procedure and air is admitted to the pipeline, or if any repair procedure results in contamination of the unit, disinfection shall be reaccomplished. Disinfection procedures shall be in strict conformance with AWWA C651.
- 3.11.2 Flushing: Thoroughly flush each segment of the system with clean, potable water, obtaining a minimum velocity of 2.5 fps for a period of 10 minutes, or until the line is free of particulates.
- 3.11.3 Chlorination: Introduce chlorinated water into the main in such volume and concentration as to achieve a chlorine concentration of 50 ppm throughout the system. Operate all valves and hydrants. Perform a chlorine residual test at each hydrant to verify concentration. Allow the chlorinated water to sit for 24 hours, then flush the mains to achieve a chlorine concentration of not more than 2.0 ppm.
- 3.11.4 Testing: Upon completion of disinfection procedures, a sample will be taken at each hydrant or test point in the system, and sent to an approved laboratory for bacteriological testing. Samples will be taken in the presence of the Owner's Representative and tests shall be paid for by the Contractor. Should the tests indicate the presence of bacteria, the system or affected segment shall be flushed, chlorinated, and tested as specified.

**END OF SECTION**

**SECTION 33 30 00**  
**SANITARY SEWERAGE**

**1 - GENERAL**

1.1 RELATED DOCUMENTS

- 1.1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

- 1.2.1 This section gives the requirements for installation of gravity sewer pipe, service laterals and manholes. Service laterals shall be installed where shown on the drawings or as directed by the Owner's representative. Excavation, trenching and back filling is covered in Section 31 20 00 Earth Moving.

1.3 RELATED WORK

- 1.3.1 31 20 00 Earth Moving
- 1.3.2 32 10 00 Bases, Ballasts, and Paving

1.4 REFERENCES

- ASTM D1784 - Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
- ASTM D1785 - Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- ASTM D2241 - Poly (Vinyl Chloride) (PVC) Pressure-rated pipe (SDR SERIES).
- ASTM D2152 - Test Method for Degree of Fusion of Extruded Poly (Vinyl Chloride) (PVC) Pipe and Molded Fittings by Acetone Immersion.
- ASTM D2321 - Underground Installation of Flexible Thermoplastic Sewer Pipe.
- ASTM D2412 - External Loading Properties of Plastic Pipe by Parallel-Plate Loading.
- ASTM D2444 - Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight).
- ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- ASTM D-3212 - Elastomeric push-on joints for plastic pipe.
- AWWA C600 - Installation of Ductile - Iron water mains and appurtenances.
- AWWA C900 - PVC Pressure Pipe 4 inch through 12 inch.
- AWWA C905 - PVC Pressure Pipe 14 inch through 36 inch.
- ASTM D2672 - Bell-End Poly (Vinyl Chloride) (PVC) Pipe.

- ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- ASTM F478 - Precast Concrete Manhole Risers and Tops.
- ASTM C497 - Concrete Pipe, Manhole Sections, or Tile.
- ASTM F679 - Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
- ASTM A746 - Ductile Iron Gravity Sewer Pipe.
- ASTM F794 - Poly (Vinyl Chloride) (PVC) Ribbed Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

## 2 - PRODUCTS

### 2.1 POLYVINYL CHLORIDE (PVC) PIPE

#### 2.1.1 Sewer mains with depth of earth cover greater than 3 feet.

- For pipe sizes 4" and 6" pipe shall be SCH 40 conforming to the requirements of ASTM D1785 with solvent weld joints conforming to ASTM D2672.
- For pipe sizes larger than 24" pipe shall be closed profile conforming to the requirements of ASTM F794 with a minimum pipe stiffness of 46 PSI and with elastomeric push-on joints conforming to ASTM D 3212 or ASTM D3139.
- For pipe sizes 8" through 12", pipe shall be Class 150, DR18 conforming to the requirements of AWWA C900 with elastomeric push-on joints (13') conforming to ASTM D3212 or ASTM D3139.
- For pipe depths greater than 14 feet and pipe sizes 14" through 24", pipe shall be Class 235, DR18 conforming to the requirements of AWWA C905 with elastomeric push-on joints conforming to ASTM D3212 or ASTM D3139.

#### 2.1.2 Fittings shall be mechanical joint ductile iron.

#### 2.1.3 Pipe and fittings used for sewer service laterals shall be 4" or 6" schedule 40 conforming to ASTM D1785 with solvent welded joints.

#### 2.1.4 Fasteners shall be 316 stainless steel or better where exposed to sewer or sewer gases.

### 2.2 DUCTILE IRON PIPE

#### 2.2.1 Ductile Iron Pipe: Conforming to ASTM A746, ANSI/AWWA C151/A21.51, Class 50, lined with Protecto 401 ceramic epoxy, "Sewpercoat" or engineer approved equal unless otherwise shown or specified.

#### 2.2.2 Joints shall be rubber gasket push-on, conforming to ANSI/AWWA C111/A21.11, or mechanical joint conforming to ANSI/AWWA C110/A21.10, as modified by ANSI/AWWA C151/A21.51.

#### 2.2.3 Fittings and specials shall be suitable for 150 pounds per square inch pressure rating, unless otherwise specified. Fittings and specials for mechanical joint pipe shall conform to ANSI/AWWA C110/A21.10. Fittings and specials for use with push-on joint pipe shall



conform to ANSI/AWWA C111/A21.11 lined with protecto 401 ceramic epoxy, "Sewpercoat" or Engineer approved equal unless otherwise shown or specified.

## 2.3 PIPE COUPLINGS

2.3.1 Couplings between dissimilar pipe materials (PVC to ductile iron) shall be as follows:

- 4" and 6" couplings: Wide band stainless steel, Fernco or approved equal.
- 8" and larger pipe: Manhole or mechanical joint ductile iron only or adapter conforming to ASTM 3139 lined with Protecto 401 ceramic epoxy, "Sewpercoat" or approved equal unless otherwise shown or specified.

## 2.4 MANHOLES

2.4.1 Manholes shall be precast concrete only conforming to ASTM C478.

- Joint surfaces between bases, risers and cones shall be manufactured to the joint surface design and tolerance requirements of ASTM C76.
- Flexible joint sealants shall be butyl rubber based conforming to Federal Specification SS-S-210A, AASHTO M-198, Type B - Butyl Rubber and as follows: maximum of 1% volatile matter and suitable for application temperatures between 10 and 100 degrees F.
- Joints between precast components shall be sealed internally between the tongue and the groove and additionally around the external perimeter as follows:
  - Internal seals shall consist of a plastic or paper-backed butyl rubber rope no less than 14 feet long and having a cross-sectional area no less than the annular space times the height of the joint.
- Pipe to manhole connectors shall conform to ASTM C923. The location of the pipe connectors shall vary from the location shown on the project plans no more than ½ inch vertically and 5 degrees horizontally. Provide for control of the pipe OD to within the tolerances of the connector on flexible pipes larger than 12 inches.
- Concrete shall conform to ASTM C478 and as follows:
  - Compressive strength: 4000 psi minimum at 28 days.
  - Air Content: 4 percent minimum.
  - Cementitious Materials: Minimum of 564 pounds per c.y.
  - Coarse Aggregates: ASTM C33.
  - Fine Aggregates: ASTM C33. Free from organic impurities.
  - Chemical Admixtures: ASTM C494. Calcium Chloride or admixtures containing calcium shall not be used.
  - Air Entraining Admixtures: ASTM C260.
- Mortar: ASTM C270, Type S.
- Grout: Grout for sealing openings and joints in manholes shall be Type S mortar.
- Brick: Brick shall be used to bring manhole rings to grade or filler for forming manhole inverts only and shall conform to ASTM C62 Grade SW or ASTM C32 Grade MS.
- Manholes 4' deep or less shall have an eccentric cone or a flat top.

- Manholes over 4 feet deep shall have an eccentric cone.
- Manholes shall have a minimum inside diameter of 4 feet for sewer mains 18 inches diameter and smaller shall be 5 feet inside diameter for sewer mains larger than 18 inches. Larger inside diameters may be required for larger pipe sizes, more than two pipes, or when entrance/exit angle requires.
- Drop manholes shall be inside drop with a minimum inside diameter of 5 feet.
- For 5 foot diameter manholes 8 feet deep or greater shall have an 8 inch extended base.
- For 4 foot diameter manholes 8 feet deep or greater shall have a 6 inch extended base.
- Manhole steps shall be provided in bases, risers, cones, transition cones and transition top sections aligned vertically on 16" centers. Steps shall be secured to the wall with a compression fit in tapered holes or cast in place. Steps shall not be vibrated or driven into freshly cast concrete or grouted in place. The steps shall be Copolymer Polypropylene Plastic reinforced with a ½" diameter grade 60 bar and have serrated tread and tall end lugs. Step pullout strength shall be tested according to ASTM C497.
- Sewer Guard Manhole Inserts: Each manhole shall be equipped with an insert of high density copolymer meeting the requirements of ASTM 124 with gas and vacuum relief valves matching manhole covers and rings. Manholes located in traffic areas shall have stainless steel sewer guards by Southwestern Packing and Seals or approved equal.
- Manhole interiors may be required to be lined to resist hydrogen sulfide corrosion as directed by the engineer. Lining material must be approved by the engineer.
- All inplace penetrations into manholes must be by core boring methods including main line and service drops. Properly sized elastomeric boots shall be set in penetrations. The boot and the pipe must be fully mortared on the inside and the outside of the manhole.
- Inside drop for sewer mains and services shall conform to the detail with all material to be 316 stainless steel or better, excluding piping.
- Vents shall be constructed of aluminum or type 316 steel or better and shall extend a minimum of 1 foot above 100-year flood and equipped with a non-corrosive bug screen. The maximum spacing is 1,000 feet separation between vented manholes.
  - Grey Iron Castings:
    - Manhole Castings: All iron casting for manhole frames and covers, inlet frame and traps and other sewer appurtenances, unless other specified, shall conform to ASTM A48 "Grey Iron Castings: Class 30B" and shall be marked "Sanitary Sewers". Standard and watertight frames shall have a 24 inch clear opening. Standard covers shall have up to four 1" diameter vent holes. All covers shall have lifting bars in lieu of pickholes. Watertight covers are required on all manholes where the rim elevation is less than 1 foot above the 100-year flood. All manhole castings shall be American made.

○ Standard frames and vented cover, manufacturer and style to be approved by submittal by the Engineer. The following are approved for use on UNC-Wilmington systems:

- 1. U.S. Foundry 725 ring and LJ cover.
- 2. East Jordan Iron Works 7 ½" Frame (in traffic areas) Product #202711, 4" Frame Product #202611 - Cover Product #202746.
- U.S. Foundry 710 ring and LJ cover (in traffic areas).
- Capitol Foundry of Virginia, Item MH-3000 ring & cover.

○ Watertight frames and non-vented cover, manufacturer and style to be approved by submittal by the Engineer. The following are approved for use:

- U.S. Foundry 725 ring and LJ-SSG cover.
- East Jordan Iron Works 7 ½" Frame and Cover Assembly (in traffic areas) Product #202701, 4" Frame Product #202611 - Cover Product #202722.
- U.S. Foundry 710 ring and LJ-SSG cover (in traffic areas).
- Capital Foundry of Virginia, Item MH-3000-WT ring & cover.

- Cleanouts: A nominal 6" diameter by 12" cast-iron box and cover shall be furnished and installed flush with the final grade at the edge of the easement or right-of-way. "C.O." shall be stamped on lid. The box shall conform to the standard detail.

- Adjusting Rings:

○ Concrete adjusting rings shall be precast and conform to ASTM C478.

### **3 - EXECUTION**

#### **3.1 PIPE INSTALLATION**

3.1.1 Install PVC pipe in strict accordance with ASTM D2321 except as modified in these specifications. Install manholes as indicated on the plans. Install Ductile Iron Pipe in accordance with AWWA C600. Excavation and backfill shall be accomplished as specified under Section 31 20 00 Earth Moving

3.1.2 Pipe shall be kept clean at all times, and no pipe shall be used in the work that does not conform to the appropriate ASTM Specifications. The laying of pipe in finished trenches shall commence at the lowest point, with the spigot ends pointing in the direction of the flow. All pipe shall be laid with the ends abutting accurately to the lines and grades as laid with the ends in the direction of the flow. All pipe shall be laid with the ends abutting accurately to the lines and grades as shown on the plans, or as directed by the Owner. They shall be carefully centered so that when laid they will form a sewer with uniform invert.

- Preparatory to making pipe joints, all surfaces of the portion of the pipe to be jointed or of the factory made jointing material shall be clean and dry. Lubricants, primer, adhesives, etc., shall be used as recommended by the pipe or joint manufacturer's specifications. The jointing material or factory fabricated joints shall then be placed, fitted, and adjusted in such workmanlike manner as to obtain the degrees of water tightness required. Trenches shall be kept dry during bedding, laying and jointing and for as long a period as required. As soon as possible after the joint is made, sufficient backfill material shall be placed along each side of the pipe to offset conditions that might tend to move the pipe off line and grade.

- Where more than one pipe line is laid in the same trench and the invert elevations are not identical, and where no concrete cradle or encasement is provided for the support of the higher pipe line, its foundation shall be considered to be yielding. When bridging is required to support a portion of the pipeline over such yielding trench bottom, the pipe line itself shall not be considered to provide bridging strength, and supplementary materials for this purpose shall be provided.

- 3.1.3 No superficial loads shall be placed on the exposed surface of the trench, unless the backfill is of noncohesive material, is vibrated or is tamped in layers not exceeding 6-inches in depth, until the Owner is satisfied that sufficient settlement has occurred to alleviate undue live or impact loads. Any defects due to settlement shall be corrected by the Contractor. Bell holes shall be dug sufficiently large to insure the making of proper joints. Water shall not be allowed to rise in the excavation until the joint material has received its set. Great care shall be used to secure water tightness, and to prevent damage to or disturbing of the joints during the backfilling process, or at any other time. Special precautions shall be exercised to prevent any pipe from resting on rock or any other hard projection which might cause breakage of pipe. During construction, the mouth of the completed pipe shall always be kept properly closed with a suitable plug to prevent the entrance therein of any water, earth, stones or other debris. The Contractor shall also take any and all measures to keep the pipe clean and free from deposits and protect the pipe from damage.
- 3.1.4 **Cleaning Pipe:** The pipes shall be thoroughly cleaned before they are laid and shall be kept clean until acceptance of the completed work. The upper end of all pipe lines shall be provided with a header carefully fitted, so as to keep dirt and other substances from entering. This header shall be kept in the end of the pipe line at all times when laying is not in actual progress.
- 3.1.5 **Shoring, Sheet piling and Well-Pointing:** The Contractor shall include in his price bid for pipe the placing of all necessary shoring, sheet piling and well-pointing, gravel bedding, and any other dewatering devices to prevent damage to other installations and where required by the Owner.
- 3.1.6 **Service Connecting:** Sewer laterals shall be connected to the main by means of a wye fitting installed in the top quadrant of the pipe but shall not be installed straight up. Where it is necessary to lay new house services or relay or tie in existing house services, the Contractor shall use the materials and type joints as set forth on the plans, as given in the specifications, or as directed by the Engineer. These services shall be sized as designated on the plans or as shown on details. The service connection shall be located such that a minimum clearance of 25 feet is provided between potable water wells and sanitary sewer lines.
- Service piping shall be perpendicular with the main unless otherwise approved by the Engineer. Where new mains are being laid, the house service shall be connected to the main by means of a wye set in the main with the branch turned up in such manner that a good square connection will be made with the grade of the house service. Service pipe shall connect to the main at manholes when noted on the drawings or when requested by the Engineer by core boring the manhole and field installation of the proper size elastomeric boot mortared inside and outside of the manhole. Service lines shall be terminated at property line or edge of easement as shown on Standard Detail.
  - All house connections shall be laid to a point from the property line as shown in details. Contractor shall provide a clean-out and stub solvent weld cap as shown in details. During installation, any services or utilities damaged by the Contractor shall be properly maintained and repaired by the Contractor at his expense.
  - All house laterals installed under paved streets shall be installed by the compacted bore method. Where conditions prohibit the use of the compacted bore method, alternate methods may be used as approved by the Engineer.

- 3.1.7 Clean-outs: Clean-outs shall be located at the right-of-way line. A 6 inch diameter cast-iron box and cover shall be provided over clean-out plug. The cast iron box shall be marked by a landscape timber - 4 feet in the ground and 2 feet exposed above ground.
- 3.1.8 Pavement Replacements: Where it is necessary for the Contractor to cut, drop, or otherwise remove pavement to install sewer lines, the Contractor shall replace all pavement in accordance with the Section 32 10 00 Bases, Ballasts, and Paving of these specifications.
- 3.1.9 Salvage: All salvage materials of whatever nature shall be disposed of at the direction of the Engineer. Particularly care must be exercised in handling salvaged materials by the contractor.

## 3.2 MANHOLE INSTALLATION

- 3.2.1 General: Manholes shall be constructed of precast concrete rings in accordance with the Drawings. The precast concrete base shall be placed on a six inch (minimum) stone bedding foundation which shall extend up around the pipes to at least 3 inches above the top line of the pipes. The stone bedding shall be considered as incidental to the unit price bid for the installed manhole. Pipes entering the precast sections of the manhole shall be inserted into the adaptor couplings provided. All precast manhole components shall be lifted and moved by use of suitable lifting slings and plugs that will not damage the precast manhole lip. All damage to precast sections shall be thoroughly repaired in the presence of the Engineer. Repair and patching of minor breaks shall be done by chipping and scarifying the defective area before application of grout. Precast sections shall be subject to rejection on account of failure to conform to any of the specification requirements. In addition, individual sections of manhole sections may be rejected because of fractures or cracks passing through the wall, except for a single end crack that does not exceed the depth of the joint; defects that indicate imperfect proportioning, mixing, and molding; surface defects indicating honey-combed or open texture; damaged or cracked end, where such damage would prevent making a satisfactory joint; and/or any continuous crack having a surface which width of 0.01 inches or more and extending for a length of 12 inches or more, regardless of position in the section wall.
- 3.2.2 The Contractor is responsible for getting the manhole tops to proper grade. Profiles on the plans are for cost estimates only. The top of the precast manhole may be brought to proper grade for receiving manhole frames by using brick with a maximum adjustment of 12 inches from precast cone to the cast iron ring. Masonry construction shall be preformed by experienced and qualified workmen. All work shall be laid plumb, straight, level, square, and true. The Contractor shall set and bond the manhole frame in a full bed of mortar. All manhole steps and miscellaneous items shall be properly bedded. The masonry walls shall be parged on the inside and outside with a ½-inch coat of Type S mortar.
- Wedging or the placing of the shims to secure proper level will not be used in setting of manhole sections. Manholes located in unpaved roads shall be constructed with top of lid located 8 inches below road surface and a concrete reference marker shall be placed at the adjacent right of way line.
- 3.2.3 Invert Channels: The invert channels shall be 3/4 the depth of the largest pipe and shall be smooth and semicircular in shape conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. The invert channels shall be formed directly in the concrete of the manhole base or shall be built up with solid brick and Type S mortar. The floor of the manhole outside the channels shall be smooth and shall slope toward the channels not less than 1 inch per foot nor more than 2 inches per foot. No laser bowl invert manholes shall be permitted.

3.2.4 Grade Rings: Manhole castings shall be installed to grade using 24 inch inside diameter precast concrete grade rings, or brick grouted in place, for a maximum adjustment of 12 inches. Manhole sections shall be used for greater adjustment, unless approved otherwise. Flat top manholes shall not be adjusted by more than one course of brick.

3.2.5 Drop Manholes: Inside drop only with minimum 5' diameter. Where sewer lines enter on a grade 30 inches or more above the invert of the discharge line, a drop manhole shall be constructed as directed by the Engineer. The drop or drops, shall be constructed in accordance with the Standard Detail, as shown on the plans, of 316 stainless steel or better excluding pipe.

### 3.3 CUTTING OF PIPE

3.3.1 Cut pipe in a neat manner without damage to the pipe or any fittings or specials.

### 3.4 ADJACENT FACILITIES

3.4.1 Water Lines: Where the location of the sewer pipe is not clearly defined in dimensions on the drawings, the sewer pipe shall not be laid closer horizontally than 10 feet from a water line except where the bottom of the water pipe will be at least 18 inches above the top of the sewer pipe. Where water lines are less than 18 inches above the sewer lines, or cross under gravity-flow sewer lines, the sewer pipe and water main for a distance of at least 10 feet each side of the crossing shall be made of ductile iron pressure pipe with no joint located within 8 feet horizontally of the crossing.

#### 3.4.2 Wells

- No manhole shall be placed within 50 feet of a well utilized for potable water.
- No sewer piping shall be placed within 25 feet of a well utilized for potable water.
- Minimum specifications for sewer piping placed between 25 feet and 50 feet utilized for potable water shall meet or exceed the requirements Class 50, ductile iron with push on joints conforming to ANSI A21.50/A21.51 lined with Protecto 401 ceramic epoxy or approved equal.

3.4.3 Sewer lines shall not be laid in the same trench with water lines, gas lines or electric wiring.

3.4.4 Storm Drains: Provide 12 inches of soil between sewer lines and storm drains. Where this is not possible, construct the sewer of ductile iron pipe or encase the sewer in concrete for a minimum distance of 10 feet centered at the storm drain. Where sanitary sewer is installed under existing storm drain structures or pipe, flowable fill as approved by the Owner and N.C. Department of Transportation, must be used where proper compaction cannot be obtained.

3.4.5 Roads and Ditches: Provide 36" minimum cover for PVC beneath the roads and ditches. When a roadside ditch is perpendicular to the sewer service, a minimum cover of 24" will be allowed. Otherwise construct the sewer of ductile iron pipe or encase the pipe in concrete.

### 3.5 MINIMUM GRADE (Unless otherwise directed or shown on the plans)

3.5.1 4 INCH PIPE: One foot per 100 feet (1.0 percent).

3.5.2 6 INCH PIPE: 0.6 feet per 100 feet (0.6 percent).

- 3.5.3 8 INCH PIPE: 0.4 feet per 100 feet (0.4 percent).
- 3.5.4 10 INCH PIPE: 0.28 feet per 100 feet (0.28 percent).
- 3.5.5 12 INCH PIPE: 0.22 feet per 100 feet (0.22 percent).
- 3.6 BACKFILL
- 3.6.1 Materials and installation of pipe bedding haunching and backfill shall be in accordance with Section 31 20 00 Earth Moving
- 3.7 SERVICE CONNECTIONS
- 3.7.1 Service Connection: Install at locations shown on the drawings, or as designated by the Owner's representative. Service connections shall consist of wye branch, fittings, cleanout, cast iron box and cover, and pipe, as detailed on the drawings. Set cleanout box on 4 inches of stone.
- 3.8 FIELD QUALITY CONTROL
- 3.8.1 Field inspection, sampling and testing will be performed per Owner's instructions.
- 3.9 SALVAGE
- 3.9.1 All salvage materials of whatever nature shall be disposed of at the direction of the Engineer. Particularly care must be exercised in handling salvaged materials by the Contractor.
- 3.10 TESTING
- 3.10.1 General: The Contractor shall be responsible for providing all equipment necessary for tests of displacement, deflection, and leakage. Tests for deflection and leakage shall be performed by the Contractor and observed by the Owner's representative. Each segment of line shall be tested after 30 days prior to final acceptance of the project if required and in any event, all segments of main and all services shall be cameraed in the presence of the District's representative at no cost to the District. The camera inspection must be performed upon completing of cleaning and potable water introduced into the system to be tested. All defects in the pipeline and appurtenances shall be remedied by the Contractor at no additional expense to the Owner and will be reinspected as outlined above. Acceptance of any deviation from these requirements is at the sole discretion of the Engineer.
- 3.10.2 Test for Displacement of Sewers: Sewer mains will be checked by the Owner's representative to determine whether any displacement of the pipe has occurred. The test will be as follows: A light will be flashed between manholes, by means of a flashlight or by reflecting sunlight with a mirror. If the illuminated interior of the pipeline shows poor alignment, displaced pipe, or any other defects, the defects shall be remedied by the Contractor. Water will be introduced into the pipe to aid in detection of defects. The owner may choose to re-inspect the pipe at its discretion, using all appropriate tests including inspecting the pipes by using a closed-circuit television camera. Any observed leakage shall be repaired, regardless of leakage rate. Acceptance of any deviation from these requirements is at the sole discretion of the Engineer.
- 3.10.3 Test for Deflection: Deflection tests may be performed on all sections of flexible pipe.
- Maximum allowable deflection shall be 5 percent at any point.

- Deflection shall be measured with a pin-type mandrel "Go/No Go" gauge. The gauge shall be pulled through the pipe by means of a strong cord or cable.
- Any section of pipe not meeting the 5 percent maximum deflective requirement shall be excavated, backfilled, recompact and retested.

3.10.4 Test for Leakage: All segments of completed line may be tested for leakage by low pressure air test, except that the infiltration test may be used as approved by the Owner's representative. The Engineer may choose to camera the pipe. Acceptance of any deviation from these requirements is at the sole discretion of the Engineer.

- The Contractor shall remedy all visible leaks in pipes, manholes, and appurtenances.
- Maximum allowable leakage for the system shall be 0 gallons per inch pipe diameter per linear mile of pipe per 24 hours, including manhole infiltration. No single segment of line (manhole to manhole) shall exceed this requirement.
- Air Testing: Air testing shall be required if, in the sole opinion of the Engineer, conditions are such that infiltration measurements may be inconclusive. The test shall be conducted in the presence of the County Engineer and shall conform to the following requirements:
  - Test pressure shall be 3.5 psi increased by the ground water pressure above the top of the sewer.
  - Pressure loss from 3.5 psi shall not exceed 0.5 psi during the required testing time.
  - Testing time in minutes shall be calculated as  $0.625 \times \text{nominal pipe size (inches)}$ .

3.10.5 Testing Manholes:

- Each manhole shall be tested immediately after assembly and prior to backfilling.
- All lift holes shall be plugged with an approved non-shrink grout.
- All pipes entering the manhole shall be plugged, taking care to securely brace the plug from being drawn into the manhole. Unless plugs are mechanically restrained, it is recommended that the plugs are used with a minimum of 2 times safety factor above the test pressure.
- The test head shall be placed at the inside of the top of the cone section and the seal inflated in accordance with the manufacturers' recommendations.
- A vacuum of 10 inches (5 psig) of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9 inches. The manhole shall pass if the time is greater than 60 seconds for 48" diameter, 75 seconds for 60".
- If the manhole fails the initial test, necessary repairs shall be made with a non-shrink grout while the vacuum is still being drawn. You shall retest until a satisfactory test is obtained.
- After the gravity sewers and manholes have been installed and backfilled, the manholes shall be inspected for leakage. No visible leaks will be permitted.

3.10.6 Test Results: Certified copies of all test results shall be furnished to the Owner and the Owner's representative within 1 week after the test.

**END OF SECTION**



**SECTION 33 32 16**  
**PACKAGED WASTEWATER GRINDER PUMP ASSEMBLIES**

**1. PACKAGED GRINDER PUMP SYSTEMS**

- 1.1 Duplex sewer grinder pumps shall be: Barnes ZOGP2072L, or written approved equal
- 1.2 Packaged System Requirements
  - 1.2.1 Wetwell:  
Fiberglass, minimum storage of three hundred and sixty (360) gallons above the PUMP OFF level, (6) inch diameter PVC inlet flange for Schedule 40 PVC sanitary line, pump discharge brass adapter socket, easily adaptable to either (1.5) inch for residential, or (2) inch for commercial applications, PVC or HDPE pipe materials, aluminum lid, mushroom vent on tank lid, extended base, integral to the tank, for anchoring the anti-flotation concrete ballast to tank, contractor shall provide concrete ballast as required, removal of pumps and / or operation of discharge valve shall not require personnel entry into the tank.
  - 1.2.2 Pump and Motor:  
Vertical rotor, motor driven, solids handling type, double O-ring seal at all casting joints, pump castings cast iron, fully epoxy coated 8-10 mils nominal dry thickness, rotor shall be stainless steel, through-hardened, polished, maximum discharge pressure shall not exceed 150 psi, with 2.0 HP standard.
  - 1.2.3 Electrical:  
208-240 VAC, 60 Hz, single phase, 3450 RPM, pump cord length (15) feet minimum, UL and CSA listed, quick connect cord for watertight attachment to pump.
  - 1.2.4 Grinder:  
Mounted directly below the pumping elements, direct-driven, fastened to the pump motor shaft by means of a threaded connection only, cutter teeth hardened to Rockwell 50-60 for abrasion resistance, solids must be fed in an upward flow direction.
  - 1.2.5 Integral Check Valve:  
Factory installed, gravity operated, flapper type integral check valve built into the stainless-steel discharge piping, must provide a full-ported passageway when open, working parts constructed of 300 series stainless steel and fabric reinforced synthetic elastomer to ensure corrosion resistance.

#### 1.2.6 Level Controls:

Starting controls to be located in the cast iron enclosure of the core unit – plastic enclosure for starting controls is not acceptable, provide float switch type level controls for PUMP OFF, PUMP ON, and HIGH LEVEL ALARM in the wet well for simplex grinder pump stations, provide float switch type level controls for PUMPS OFF, LEAD PUMP ON, LAG PUMP ON, and HIGH LEVEL ALARM for duplex grinder pump stations, pump on / off and high level alarm functions shall not be controlled by the same switch.

Float switches shall consist of a mercury tube switch sealed within a corrosion resistant polypropylene housing with a minimum (18) gauge, (2) wires, SJOW / A jacketed cable. The cable shall be of sufficient length to reach the connection junction box without splicing. The floats shall be suspended from a stainless-steel support bracket mounted inside the wet well such that any adjustment or replacement may be done without entering the tank. Float level controls shall be UL / CSA listed and approved.

#### 1.2.7 Power and Control Cables:

The power and control cables shall be a minimum of (25) feet long or as needed to connect the wet well to the pump control panel. The power and control cables shall not be spliced between the wet well and pump control panel. The cables shall be UL / CSA listed and approved. The power and control cables shall be installed in minimum (2.0) inch PVC conduit (duplex pumps). The conduit ends shall be sealed at each end with non-hardening duct sealant.

At the discretion of the Engineer a direct burial rated power and control cable assembly may be utilized. Any direct burial cable assembly shall be UL / CSA listed and approved.

Connection of power and control cables at the wet well shall be a sealed watertight connection. Power cable shall be sealed at the motor and clamped in place with a rubber watertight seal bushing to seal the outer jacket against leakage and to provide for strain relief. Cables shall withstand a pull of 300-pound force.

#### 1.2.8 Control Panel:

Automatic control panel, NEMA 4X rated, UV resistant, UL listed for wall or pole mounting, hinged, lockable cover, high level alarm with red lexan (polycarbonate) alarm light and alarm horn, must be mounted so the alarm light is visible from the street, control panel must be within line-of-sight of the wet well, a placard shall be affixed to the control panel with the Brunswick Community College emergency phone number on the placard for the owner's use and a 2<sup>nd</sup> copy of the placard placed inside the panel.

All internal wiring to be neat and color coded. A schematic wiring diagram shall be permanently affixed to the inside of the panel door. An installation and service manual for each control panel shall be provided to Brunswick Community College.

All conduits shall enter the bottom of the control panel and utilize a watertight hub — Myers or written approved equal.

1.2.9 Manual Transfer Switch

Provide and install a manual transfer switch for connection to a portable generator- See Plan Sheet C6.

1.2.10 Auto Dialer

Provide and install an auto dialer to connect Brunswick Community College in the event of an alarm. See Plan Sheet C6.

1.2.11 Local Disconnects:

Duplex Pump local disconnect: 208 - 240 VAC, double pole, single phase, (60) ampere rated electrical disconnect is required adjacent to the grinder pump control panel. Disconnect to be UL listed and rated for outdoor applications and installed per all NEC and Authority Having Jurisdiction (AHJ) requirements.

This disconnect is required on the branch circuit supplying the duplex grinder pump panel and shall be installed before energizing the grinder pump system.

1.2.12 Warranty:

Minimum (2) year parts and labor warranty on the complete station and accessories, including, but not limited to, the control panel, pump and motor assembly, and integral check valve.

**END OF SECTION**

**SECTION 33 40 00**  
**STORM UTILITIES**

**1. GENERAL**

- 1.1 DESCRIPTION: The Work consists of provision and installation of collection structures, pipe, headwalls, and related items to collect and discharge stormwater run-off. Construction of trenches, ditches, and swales shall be in conformance with SECTION 31 20 00 EARTH MOVING.
- 1.2 STANDARD SPECIFICATION: North Carolina Department of Transportation "Standard Specifications for Roads and Structures." (NCDOT)

**2. PRODUCTS**

**2.1 PIPE**

- 2.1.1 General: Pipe sizes and grades shown on the plans are for smooth wall pipe. Where a specific pipe material is indicated on the plans, no substitute will be accepted.
- 2.1.2 Reinforced Circular Concrete Pipe: ASTM C76, Class III with tongue and groove joints and preformed mastic joint filler. Class IV RCP required when cover is less than 1 foot.
- 2.1.3 Box culverts shall be in accordance with ASTM C850. All culverts shall be HS20 load rated.

**2.2 DRAINAGE STRUCTURES**

- 2.2.1 General: Manhole and inlet structures shall be pre-cast concrete with preformed holes or knockout panels, unless otherwise approved. Minor deviations in dimensions for pre-cast structures will be acceptable. Structures may be constructed out of structural block if approved by Engineer.
- 2.2.2 Pre-cast Concrete Manholes: ASTM 478 with eccentric cone tops and pre-cast base sections, unless shown otherwise. Manholes less than 4 feet deep shall have flat slab top. Minimum inside diameter of base section shall be 4 feet, with actual diameter to be determined by the Contractor and manhole supplier based on the number, size, and angle of pipe connections for each manhole.
- 2.2.3 Pre-cast Concrete Inlet Boxes: Boxes shall be constructed in accordance with ACI 318, designed for H20 live loads, with knockout panels all four sides. Minimum inside area of box shall be 5 square feet.
- 2.2.4 Steps: ASTM C478, polypropylene encapsulated Grade 60 steel bars.
- 2.2.5 Frames, Grates, and Covers: Cast iron conforming to ASTM A48, Class 30B designed for water live loads. Dimensions shall conform to the Drawings in essential details.
- 2.2.6 Flared End Sections:

- a. Concrete: reinforced concrete AASHTO M170.
- 2.3 FILTER FABRIC: Non-woven synthetic fabric, NCDOT Section 956-1.
- 2.4 STONE: Stone used for bedding, riprap, and drainage shall meet requirements of SECTION 31 20 00 EARTH MOVING of these specifications (Class I rip rap granite rock).
- 3. **EXECUTION**
  - 3.1 RELATED WORK: Excavation, trenching, backfilling, and compaction shall be in conformance with SECTION 31 20 00 EARTH MOVING, except as modified herein. Provide proper clearance of water, sewer, and other utilities as specified within these specifications.
  - 3.2 PIPE
    - 3.2.1 General: Pipe shall be new pipe, free of defects, and stored in acceptable manner. Damaged pipe shall be removed from the site. Install pipe from low point of system, true to line and grade, with bell or groove end facing upstream. Maintain trench free of surface or ground water. Installation shall conform to the respective recommendations of the pipe manufacturer or trade association, except as modified herein.
    - 3.2.2 Concrete Pipe: ACPA "Concrete Pipe Installation Manual."
    - 3.2.3 Provide 1 foot minimum over pipe prior to allowing traffic over trench. Clean pipe of all debris and soil.
  - 3.3 STRUCTURES
    - 3.3.1 Bedding: Provide 8 inches minimum washed stone / gravel (#4 or #57) beneath structures to 6 inches outside of structure.
    - 3.3.2 All pre-cast structures shall be H20 load rated. Pre-cast structures shall be set plumb, with pipes centered within knockout panels. Provide opening of minimum size to accommodate pipe. Grout pipe in place with non-shrink grout.
    - 3.3.3 Inverts shall be preformed or formed with concrete or brick and concrete. Provide 1 inch per foot slope to the flow line of the structure. For structures designed to collect sediment, floor of basin shall be minimum 12 inches below lowest pipe invert with 1/2 inch diameter weep holes spaced 6 inches on center each way across bottom.
    - 3.3.4 Steps: For structures greater than 3 feet deep, provide steps 12 inches apart with alternate steps off 6 inches horizontally, beginning two feet below top of frame. Install in conformance with manufacturer recommendations.
    - 3.3.5 Frames and Grates: Center frame castings above structure opening. Adjust to grade with pre-cast concrete grade rings, brick, or mortar for a maximum adjustment of 12 inches.

**END OF SECTION**